SCIENTIFIC AMERICAN

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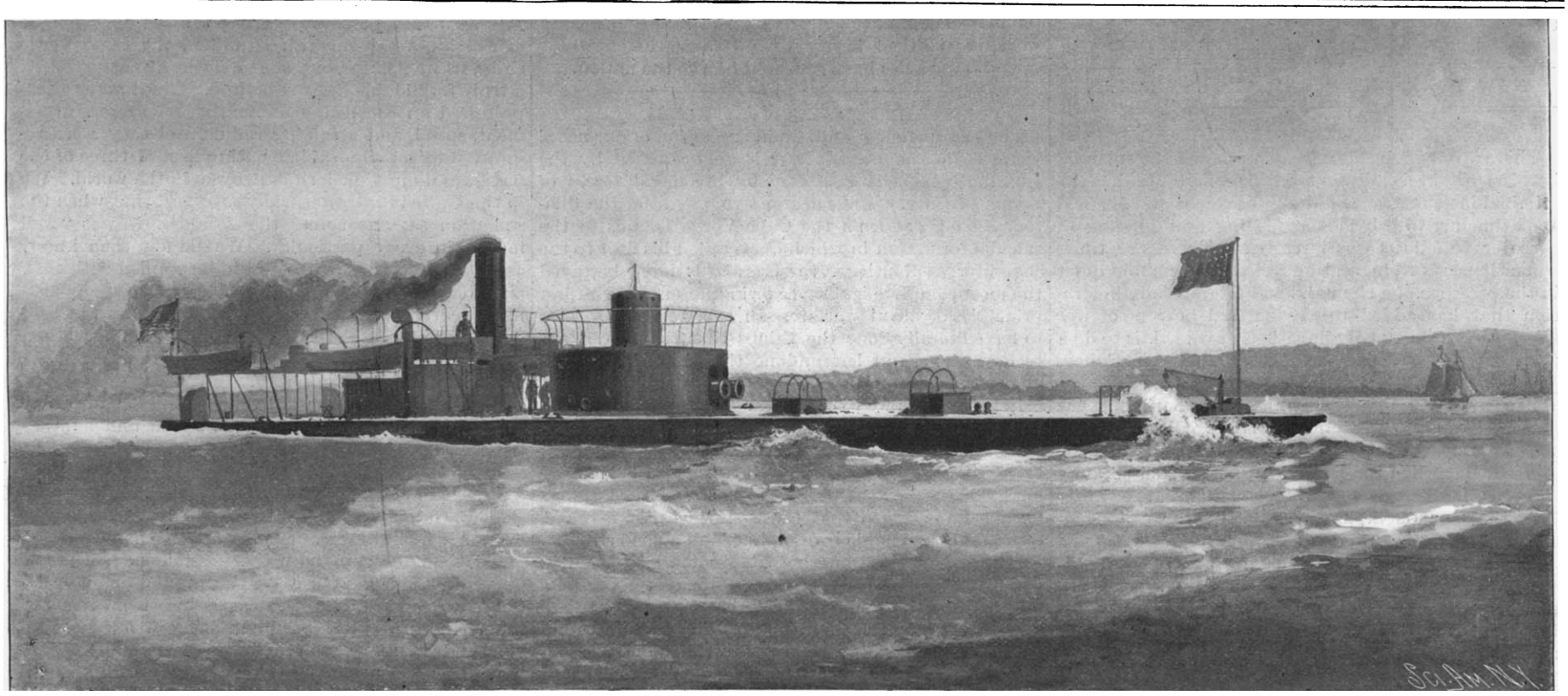
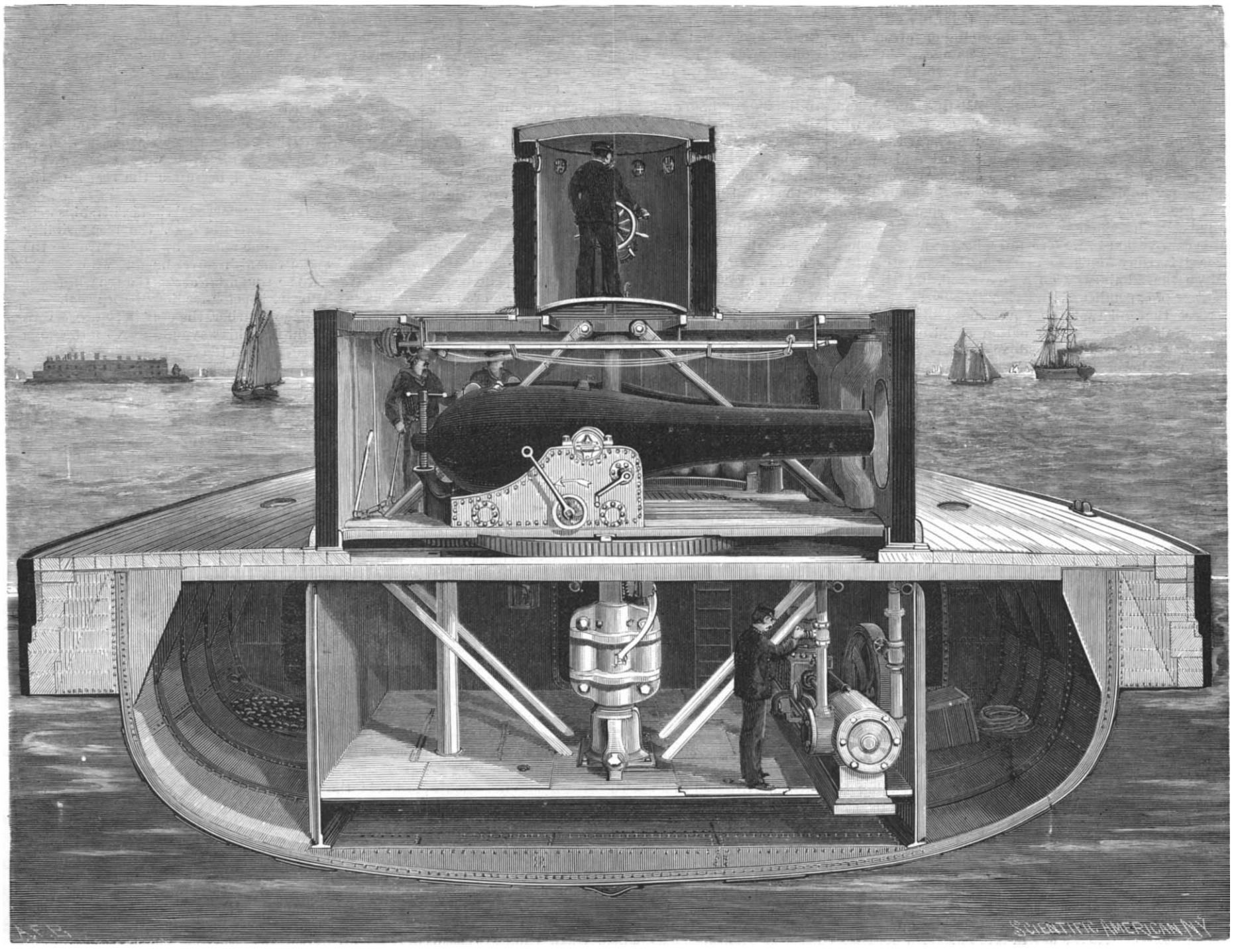
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS CHEMISTRY, AND MANUFACTURES.

Vol. LXXIX.—No. 7. ESTABLISHED 1845. NEW YORK, AUGUST 13, 1898. $3.00 A YEAR. WEEKLY.

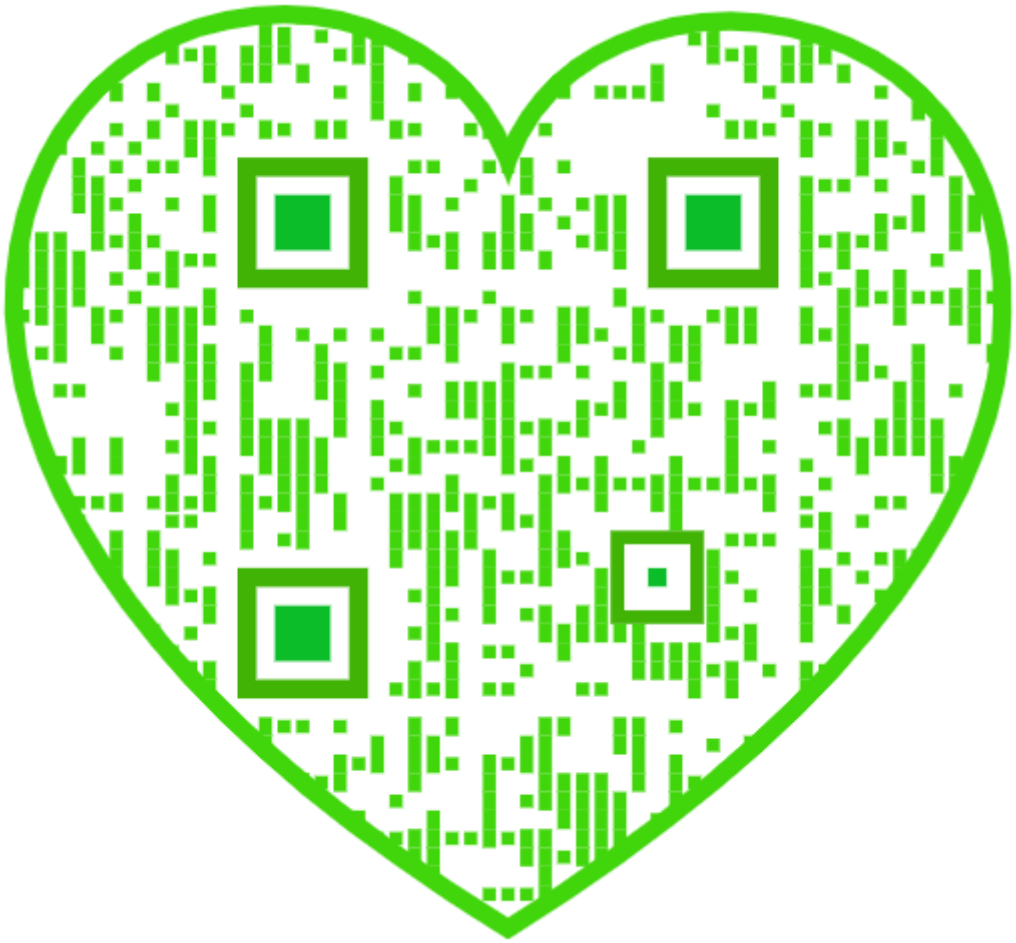


THE MONITOR "NAHANT."

DISPLACEMENT, 1,875 tons. SPEED, 5½ knots. ARMOR: Sides, 5 inches iron; turret, 11 inches iron. ARMAMENT: Two 15-inch smooth-bores, two small rapid-fire guns. AUTHORIZED April 16, 1862.



TRANSVERSE SECTION THROUGH MONITOR "NAHANT" AT THE TURRET.—[See page 104.]



Scientific American.

ESTABLISHED 1845.

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year.
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Edition (Established 1885). ..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, AUGUST 13, 1898.

THE SANTIAGO TRAGEDY.

There is only one thing that can match the splendid heroism of our soldiers at Santiago, and that is the criminal incompetence of the Subsistence and Medical Departments, to which the feeding and nursing of these brave fellows was intrusted. There are times when silence is a sin, and we feel that to remain quiet in the presence of a shameful and fatal maladministration that has added to the natural horrors of war others that might easily have been avoided, is to do a positive wrong to the heroes of Guantanamo, El Caney, and San Juan.

The wretched bungling which has marked every phase of the Santiago campaign in the Medical and Subsistence Departments is bad enough, Heaven knows, in itself, but when the Secretary of War deliberately proceeds, for reasons best known to himself, to whitewash the department, he not only betrays a callous indifference to the army whose sufferings have been aggravated by the inexcusable incompetence of his subordinates, but he deliberately insults the American people as a whole. A more ill-timed statement than this "apology" or one in worse bad taste (considering the time, circumstances, and Mr. Alger's responsible position) we do not remember to have heard or read in the half century of the existence of this journal.

The people of this country have acquired a reputation for remarkable patience and long suffering; and we think that never did they show it in such a supreme degree as the present. It was hard for our citizens to surrender the very flower of our young men from their homes to be dispatched on a fatal campaign in one of the most pestilential climates of the world. But the surrender was made with the loyal response which marks a truly patriotic people. All that they asked, the least that they expected, was that the men who had volunteered so freely should receive at the hands of the country every possible safeguard and support that is known to modern science. The American people never doubted for a moment that its army would get the best of food, the best of transportation, and the best of nursing and medical care in the field. In this expectation they were fully justified. They had voted lavishly funds to carry on the war, they had given the administration a free hand, in fact, in the matter of expenditure, and they had every reason to expect that all that the government of a wealthy, powerful, and resourceful nation could do to soften the rigors of war would be done.

As a matter of fact, they have seen our army of invasion subjected to inconvenience, hardship, and positive sufferings for which there is not the slightest excuse, and which were entirely due to the amazing incompetency of the medical and subsistence departments. Everything, indeed, was favorable, highly favorable, to the successful landing of troops and supplies and the keeping open of communication. We had the complete command of the sea and abundance of ships for transportation; the campaign was being carried on at our very doors, and the field of battle lay but a few miles from the point of debarkation. Yet, as a matter of fact, our troops had to go through the fierce fighting at Santiago in a half starved condition, and what food they secured was often of the vilest description. The wounded at the front, thanks to the lack of ambulances, had to drag themselves painfully many miles to the rear, only to find a hospital that was without tents, medicine, bandages, ice, and many of even the simplest necessities for "first aid." No "whitewash" can obscure these facts which first came in the press dispatches, and are now daily being corroborated by private letters from our unfortunate soldiers themselves.

Our army triumphed; but in the hour of victory the dreaded fever made its appearance, spreading so rapidly that the victims were soon numbered by the thousand. The first duty of the Secretary of War, one would have thought, was to place the army, or the greater part of it, on transports, and remove it to its native northern home. But no. The political demands of the hour had other calls upon the transports, to satisfy which, they were hurried home in order to carry an army of 15,000 men to a so-called invasion of Porto Rico. This pleasure trip was organized, it seems, in compliance with certain political demands, the righteousness of which appears to have commended them to the secretary's good military judgment. Meanwhile the sick, wounded, and dying troops were to be dispatched to the interior of Cuba until the conclusion of the Porto Rico junketing trip would set free the transports to bring home what was left of the Santiago army.

Our beloved country is just now passing through a crisis which, in its profound importance, can only be likened to the throes of the revolution which gave the country birth or the terrific struggle of the civil war. The demand of the American people at such a time is that its high officials shall be distinguished by the purest and most unquestioned patriotism. It has nothing but scathing rebuke for such questionable politics as are evidenced in the recent publication of the partial contents of a private letter, in the hope of working political injury to a soldier citizen whose splendid qualities have endeared him to the nation.

SPAIN'S LOST OPPORTUNITIES.

The completeness and rapid succession of our naval victories in the present war is only equaled by the amazing incapacity exhibited by the naval forces of Spain. In every stage of the struggle, from the dilatory setting out from the Cape Verde Islands to the suicidal formation in which Cervera led his fleet to the slaughter at Santiago, the Spaniards have betrayed the most complete ignorance or indifference to the first principles of naval warfare. In every case they seem to have literally done the things that they ought not to have done, and left undone the things that they ought to have done.

In saying this we wish to bear tribute to the excellent qualities of the Spanish sailors as distinct from the officers who command them, or perhaps we ought to say the Minister of Marine, who seems largely to have directed the movements of the fleets. It has always been acknowledged that the Spanish sailor is brave, thoroughly amenable to discipline, and a good seaman. In the present war, notably at Manila, he has stood pluckily to his guns under terrific fire, and there is no question that if he had received the proper and necessary target practice, the casualties on our side would not have been so invariably and ridiculously small. The incapacity, unpreparedness, and mismanagement of the navy are due chiefly to the Spanish Minister of Marine, and in a less degree to the commandants of the various fleets.

The unpreparedness and mismanagement we can understand. They are the outward and visible signs of the grave national sins of procrastination and corruption, the existence of which not even the Spaniards themselves attempt to deny. Witness the reply of the captain of the "Christobal Colon," when asked where the missing 10-inch guns of that vessel might be: "In the pockets of the Minister of Marine." This state of things is essentially Spanish, and, therefore, not unexpected. What was unexpected was the display of either carelessness or incapacity by the commandants of the Spanish fleets, whether in American or Asiatic waters.

The first inkling of what to expect was given by the easy escape of the "Paris" from the English Channel some days after the declaration of war. Spain at that time had available at least half a dozen torpedo boats, or torpedo boat destroyers, with speeds of from 25 to 30 knots an hour—two of these being actually at the entrance to the Irish Channel and just down from the Clyde. The destroyers being seagoing boats of 380 and 400 tons, were easily capable of overhauling the 20-knot "Paris," even if she secured a start of several hours, and by using the torpedo boats and one or two smaller cruisers as scouts, it would have been possible to report and run down the liner with almost absolute certainty. The "Paris" was altogether unarmed, and on being overhauled would have faced the alternative of being torpedoed or captured. Had the conditions been reversed, had we possessed the 30-knot destroyers and Spain the Atlantic liner, it is safe to say she would not have escaped. As a matter of fact, Spain did nothing, and this valuable ship ran unmolested out of the Channel and home to New York.

At Manila the same carelessness or indifference (we know not which to call it) was evident. A position which might have been rendered exceedingly strong and perilous to the attacking force was rendered easily assailable through the dilatoriness of the home government and the inexcusable carelessness of the fleet and garrison. Had the harbor been properly mined, Admiral Dewey's victory would scarcely have been possible without the loss or disablement of some of his fleet. Admiral Montojo claims that requisition had been sent to Madrid for torpedoes, but that these were never forwarded. Granted this was the case, it does not excuse the neglect of the most ordinary precautions which is evident both in the fleet and the fortifications on the morning of May 1. No watch appears to have been kept at the forts on Corregidor Island, at the entrance to the harbor, and it was not until the last ship of the column had safely steamed by that a futile shot was fired at the American squadron. This unpreparedness was bad enough, but it was surpassed by the condition of Montojo's fleet, which, when Admiral Dewey opened fire, was found lying at anchor and without steam in the boilers. Surely, one would have thought, in view of the near approach of the enemy, the Spaniards would have kept their ships in such condition that they could move at a moment's notice into some sort of fighting formation.

The climax to Spanish naval incapacity was reached in the handling of the Cervera squadron. We doubt if anything to surpass it has ever happened in the annals of naval warfare. Had the vessels been in good condition and been placed in competent hands, the fleet might have made a creditable if not a brilliant record. As it is, the whole story of its maneuvers is one of aimless wanderings, ending in a fiasco—the voluntary entrance into Santiago—as ridiculous, surely, as any that is chronicled in the records of naval and military operations.

In its innate potentiality, its peculiar fitness for the exigencies of the Spanish situation, the Cape Verde ships, as we pointed out some months ago, constituted a truly formidable little squadron. The four cruisers possessed an excellent combination of armor, armament, speed, and steaming radius, and they were reinforced by an admirable scouting fleet of three of the fastest and most modern destroyers in the world. We in the United States naturally supposed that when the squadron set out across the Atlantic, it was "well found" in every particular. We did not then know, as we do now, that it was but half supplied with coal, and that its finest ship, the "Christobal Colon," had never received its main battery of 10-inch guns. These defects are to be charged to a rotten administration, and, in all fairness, cannot be laid at the door of the unfortunate Admiral Cervera.

Now the moral and actual value of this squadron lay above all in this combination of speed and fighting power, but particularly in its mobility. So long as it was on the high seas, and not reported, it constituted a menace to our whole plan of campaign, and no invasion of Cuba was or would have been attempted as long as it was at large. Our own fleets had to be disposed so as best to meet the possible movements of Cervera. Schley, with his flying squadron, was detained at Hampton Roads, so as to be within reach of the northern Atlantic coast, and many of our fast regular and auxiliary cruisers, which should by rights have been scouting far to the eastward, keeping touch with the Spanish fleet, were detained off the New England coast in answer to the urgent appeal of the panic-stricken citizens of Boston, Portland, and other northern cities. So much of a diversion in favor of the beleaguered island of Cuba was Cervera able to effect without striking a blow; and had he remained upon the high seas, meeting his colliers at rendezvous well to the north or south of the sphere of action of our vessels, he might have postponed for many months the final crisis of the war. But for some reasons, best known to himself or the Minister of Marine, he deliberately elected to run into Santiago Harbor, where, for all practical purposes, his ships were as useless to Spain as they now are lying upon the rocks of the Cuban coast.

It is said that he was "starved," that is, his ships were short of coal. If this was the case, the responsibility is only shifted back one remove and placed upon the shoulders of the Spanish government, who should never have sent the squadron across the seas unless it had made full provisions for feeding it with coal.

Once in Santiago Harbor, the only hope of Cervera was that he might fight his way out, not with the hope of escape so much as with the determination to sell his ships dearly and work all possible harm to the enemy. He elected to give battle on that memorable Sunday morning, and his plan of action was the very worst he could have adopted either for the protection of his own ships or the destruction of the enemy. By coming out in column ahead and stringing his vessels out in a single line along what, in respect of the inevitable storm of American shells, might be termed a lee coast, he placed it in the weakest possible formation, and presented it for destruction in detail, broadside on, by the powerful guns of our battleships. Far better would it have been to have formed in line abreast, with the destroyers in the center and to the rear, and to have run the ships boldly, ship for ship, against the circle of blockading vessels. This would have given the Spaniards many opportunities and advantages which they lost by attempting a running fight. First it would have equalized matters somewhat in regard of gunnery, the Spanish gunners being scarcely able to miss as the two lines passed through each other. It would have given the fast cruisers the chance to use the ram, an advantage which would have been greatly increased by the fact that on all our ships steam and speed were low and they would have found it difficult to avoid the charge of the faster cruisers. Moreover, the destroyers could have been brought up to our line in the lee of the cruisers, and, once among our ships, they would have had some chance to get home a torpedo. All of the Spanish ships, moreover, carried a large supply of torpedoes, the "Colon" having four and the other three ships six discharge tubes. It is evident that in a fight at close quarters the chances of hurting our ships were immeasurably greater than in the long drawn out formation which Cervera preferred to adopt.

GOLD FROM THE SEA.

The lust for gold has always been a marked characteristic of the human race, and in the nineteenth century it has been greatly aggravated by the discoveries of gold in California, Australia, Africa, and in the Klondike. Besides the men who bravely battle for gold in the mining camps there are others, fortunately very few in number, who aim to arrive at affluence by an easy path. It is strange that in the present century, with all our scientific knowledge, there are those who still cling to the old belief of the alchemist that they can transmute a base metal into gold, and in their endeavor they waste their lives, their substance, and even the substance of credulous friends. There are still others who spend their time in imposing bogus experiments on gullible dupes who allow themselves to invest their money in the most crack-brained schemes.

We have now to relate the most extraordinary story connected with the production of gold, which should be a warning to all who do not see in such affairs the specious combination of science and the wily swindler. We refer to the Electrolytic Marine Salts Company, which has recently attempted to extract gold from the sea, though the resulting gold in reality came from the pockets of the shareholders. The sensational débacle of the principal promoters of the company has produced considerable comment.

In 1872 Sonstadt discovered the minute presence of gold in sea water, and this was confirmed by Prof. Liversidge, of the University of Sydney, who found that in the sea water of New South Wales there was from one-half to one grain of gold to one ton of sea water, or 130 to 260 tons per cubic mile. Prof. Liversidge estimated the bulk of the oceans of the world as 308,710,679 cubic miles, and if each ton of sea water produced one grain of gold the aggregate amount would be $48,000,000,000,000, being 23·22 grains fine to the dollar. After this discovery, it is, of course, natural that scientists should have made attempts to secure the precious metal, by treating the sea water chemically and electrically, but it was soon discovered that such processes would be wholly impracticable, owing to the great expense attending the extraction of the gold from the enormous bulk of liquid. The matter should have ended here, but it got to be pretty well understood by the public that sea water contained gold. This fact afforded an ideal chance for the alleged inventor to devise a process for extracting the gold. A few months ago the Electrolytic Marine Salts Company was formed, and the good people of New England were asked to become shareholders, and soon nearly $1,000,000 of the $10,000,000 capital stock was subscribed. The enterprise belongs to the class which depends for success upon a secret process, which is in itself often a suspicious circumstance. Moreover, the men who devised the scheme for the extraction of the gold did not belong to the class from whom we are wont to expect great things in processes which require scientific attainments. Experiments were conducted near Providence, and a New York daily paper has been enabled to give a full outline of the ingenious trick. The capitalists were allowed to see the workings of the alleged invention. They were taken to a shed built on an old dock, and they were allowed to bring their own mercury and put it into the submarine tank, which was brought up to the surface by a winch. After the tank was properly arranged, it was lowered to the bottom and the current was turned on, and the investors sat around to await results. A diver, who has now fled the country, walked on the bottom of the sea at this point and substituted mercury specially prepared with gold for the mercury which the gentlemen had furnished. When the tank was brought up to the surface, the mercury was given to an assayer and $4.50 worth of gold was found, which was considered a very good sum for a single "accumulator." Capital now came easy after this; so that a large plant was erected at North Lubec, Me., so as to get "fresh" sea water. One plant had 240 accumulators at work. They are so located that the tide water passes through them and it is treated with chemicals and electricity, that never-failing aid to bolster up secret processes. It was claimed that gold and silver, one part of the former to two of the latter, were extracted from the water and that these metals were removed from time to time about once a week. It was held as a theory that a ton of sea water contained four cents worth of gold. It was claimed as a practice by the company that four mills' worth was taken from each ton of water and that each accumulator earns on an average $1 net a day. Each accumulator separated and used about twenty tons of sea water an hour for sixteen hours out of every twenty-four. It was claimed that the consumption of chemicals was very small. The machines appeared to do their work miraculously well, and each week a gold brick worth nearly $2,000 was sent to the city. The weekly gold brick was about the same weight and value, which showed that the machinery was working remarkably well and that the amount of gold in the water was a constant quantity, and the sixteen consignments netted $23,000. Finally the vice-president and general manager's financial operations in New York aroused the suspicions of the banks, which led to his flight and the discovery of the swindle, and both he and his diver sailed for Europe; and the deluded members of the company, who believed that the scheme was feasible and went into the business in good faith, are now going to work the plant themselves before they decide to admit that they have been deceived by perhaps the most astonishing and picturesque swindle of modern times. The moral to be drawn from this is that persons should not invest in any electrical or chemical process which they do not understand, until they have asked the opinion of some expert and for whose opinion they can well afford to pay.

LANGUAGE OF THE EYE.

There seems to be considerable difference of opinion as to the influence of the emotions upon the pupils of the eye. That they do exert a marked effect would appear to be a common belief from the frequency with which novelists remark upon eyes "blazing with anger," "on fire with rage," and exhibit "a cold, steely look, enhanced by dilated pupils."

Sir S. Wilkes, the distinguished president of the Royal College of Physicians, after long inquiry, was unable to obtain any trustworthy information upon this subject, hence undertook a personal investigation, with the result he discovered the pupil of the eye in birds under the influence of anger became contracted.

Louis Robinson, who sums up his conclusions in a paper contributed to a recent number of Blackwood, was also led to investigate, by observing the pupils of a fox terrier, when teased beyond endurance, became greatly dilated, and that the eye-chambers reflected light in exactly the same way as those of the human when under the dilating influence of belladonna or atropine. He discovered the same phenomena extended to cats and monkeys when enraged and meditating mischief; but that, when making an attack, the pupils became suddenly contracted. He suggests, as a solution of this dual phenomenon, that when an animal is angry and face to face with a foe, but has not decided upon the most effective mode of assault, it is important the eyes should take in as much as possible of the opponent and his surroundings; but, when the actual onslaught is made, the attention of the assailant is suddenly concentrated upon some particular point of its adversary's body.

Robinson's explanation is ingenious, to say the least, but it does not explain why an enraged cat—and more rarely an angry dog—before the actual assault is made, often exhibits alternate contractions or expansions of the pupils.

That the eye is an index to the emotions is not to be doubted. The horse that rolls its eyes, exhibiting a dilated pupil and an undue proportion of sclerotic (the "white" of the eye) is always recognized as tricky and unsafe. While it is doubtful if the eyes of man "blaze" or exhibit a "fiery glint" when the possessor is enraged, there may usually be observed a change in the pupil, often considerable contraction, which in a blue or light gray eye is best described as a "steely glitter." Notably most blue, gray, and hazel eyes are capable of a most wonderful expression, but light blues ("buttermilk" or "fish" eyes) and blacks are often expressionless. Kind and mild expressions are conveyed by the eyes, are not mere figures of speech. Neither is the declaration that the eyes "are the windows of the soul and temperament" without a great measure of truth; but the more intimate relations of the organs of vision to mental conditions require more study than has yet been bestowed, and these relations in connection with mental alienation—the different forms of insanity—though long recognized as existent, strange to say have attracted little attention.

A WISE REVISION.

The navy officials are to be congratulated on their prompt determination to discard the plans for our next three battleships, and prepare altogether new designs which will embody the very latest ideas as to speed, armor, and armament. The new ships are to be of 13,000 tons displacement and not less than 18 knots speed.

We pointed out last week, when it was proposed to meet the difficulty half way by awarding the contract to the builder who would guarantee the highest speed, that the makeshift was a poor one, and that the only way to secure a higher speed, without sacrificing some other qualities in the vessels, was to increase their displacement.

On a given displacement it is only possible to do so much, and if the guns are large and numerous, the engines and boilers must weigh proportionately less. The old adage that one "cannot eat one's cake and have it" is never more true than in warship designing; if one element in a ship is abnormally heavy, the others must be just that much lighter. A ship may be all speed and guns, as in the case of the 20-knot "Sardegna," of the Italian navy, but like her she will have to give up side armor altogether; or she may be strong in guns and armor, like our "Indiana," in which case, like her, she must be content with 15·5 knots speed. The only way to increase the speed of an "Indiana" without reducing her armor and armament is to increase her size by a thousand or fifteen hundred tons, alotting the increased displacement to more powerful motive power and coal bunker space.

The minimum speed of the new battleships is to be raised from 15 knots to 18 knots. To be convinced how impossible it would be for any contractor to have done this on a given displacement is evident when it is borne in mind that the resistance of a vessel, and therefore the horse power required to drive her, increases practically as the cube of her speed. If the horse power for 15 knots is say 9,000, to drive the same ship at 18 knots would require 15,600 horse power. But to install this would require heavier engines and boilers and a larger coal supply, and therefore that much larger displacement and greater bulk of ship. But the larger ship would mean more surface to be covered with armor and hence still greater displacement. Following out this line of thought, we can easily understand how the latest 18¾-knot battleships for the British navy, with their big coal supply and large stores for distant voyages, require a displacement of 15,000 tons to accommodate all the requirements.

Our new ships are also to contain no wood, whether in decks or fittings, that is not fireproofed. In view of the Santiago conflagrations, the wisdom of this decision calls for no comment. It is also probable that our future ships will be sheathed with wood and coppered, a change which, in its way, is of scarcely less importance. A sheathed and coppered vessel can remain at sea without docking when an unsheathed vessel would have to make for the nearest dry dock to be scraped and painted.

The changes proposed by the Secretary of the Navy and acquiesced in by the Board of Construction will increase the value of the three new battleships immeasurably, and with their high speed, powerful batteries, and ability to keep at sea for lengthy periods they will be well up in the front rank at the time when they go into commission, which was more than could be said of the discarded designs for 15-knot vessels.

EXTENSION OF PNEUMATIC MAIL TUBES TO BROOKLYN.

On August 1 the formal opening took place at the Brooklyn Post Office of the new mail pneumatic tube, eight inches interior diameter and one and sixty-three one-hundredths miles long, connecting the Brooklyn Post Office, via the Brooklyn Bridge, with the General Post Office in City Hall Park, this city. There were about two hundred representative business men present, and brief speechmaking as to the value in the saving of time in the transmission of letters was indulged in. Then Postmaster Wilson sent the first official carrier through the tube, in which was placed the names of all the guests present.

It was opened and the list read at the New York office, the carrier again replaced in the tube and returned to Brooklyn, the trip over and back occupying six minutes and two seconds. The average time of the carrier in making the trip one way is two minutes and thirty-five seconds.

The tube is to be used only for the transmission of first-class matter. Each carrier holds four hundred and fifty letters, and it is expected the capacity of the tube will be sufficient to carry at least twenty per cent of the mail matter that daily passes between the two cities. The dispatching and receiving mechanism used at each end of the tube is the same as that illustrated in the SCIENTIFIC AMERICAN of December 11, 1897. The tube was constructed by Belden & Company, contractors, for the Tubular Dispatch Company, which is to receive from the United States government a rental of $14,000 per year. The tubes connecting the Grand Central Branch office, near Forty-second Street, and the intermediate branch offices and the General Post Office, have operated very satisfactorily, and greatly expedited the mail service.

It is to be hoped these tubes may be extended in other directions, that a larger area of the city may thereby be benefited by more prompt service.

PREVENTION OF COLLISIONS AT SEA.

Referring to the subject of the use of the thermopile in the prevention of collisions at sea in fogs, as described in the SCIENTIFIC AMERICAN and SUPPLEMENT of August 6, 1898, Mr. Hermann Herberts wishes to say further:

"It was not particularly pointed out that a source of heat may be employed, and its radiations be projected by suitable means into the thermopiles for the purpose stated. This being so self-evident, in view of what has been said, that I did not point it out directly.

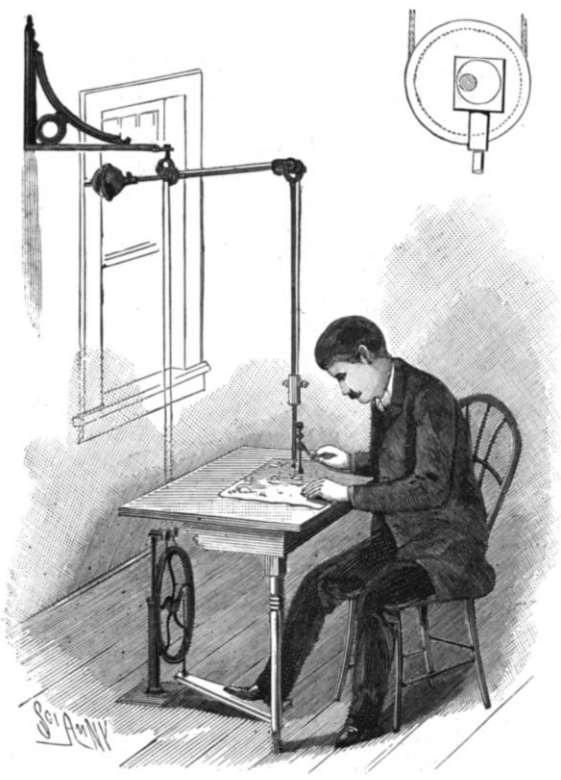
"My particular aim was to establish an entire independency of any vessel from the others. If attained, it would, of course, be the ideal solution of the problem.

"However, to what a distance the heat radiations, emanating, for instance, from a sailing vessel, may be transmitted, and how much of their effects on the thermopile would be lost, due to absorption on a foggy atmosphere, experiment will tell. Should such effect be not sufficiently strong enough to actuate the apparatus at safe distance, then, of course, the projecting of radiations from a stronger source may be employed."

AN IMPROVED STENCIL PERFORATING MACHINE.

In the manufacture of stencils used especially for stenciling designs on cloth, leather, and other goods there has long been the need of a perforating machine simple in its construction, adjustable to the various requirements, and convenient in operation.

The machine which is the subject of our illustration combines all these desirable qualities, instead of having the perforating mechanism suspended from an upright rod, as is customary. A wall bracket is provided from which the mechanism is suspended and balanced by a weight so that it may be swung in any direction to suit the work. Under the table is the foot treadle, which operates the cord belt passing over pulleys and



STERNFELD'S STENCIL PERFORATING MACHINE.

down to the reciprocating shaft located just above the needle. The needle rod is operated vertically by the eccentric on the shaft, as shown in the diagram in the upper right hand corner of the engraving. Attached to the tube through which the needle rod passes is a finger ring for guiding the needle over the pattern and a clamping screw for holding the sheets of paper firmly in place near the needle. The needle itself is also adjustable on the end of the reciprocating rod to suit different thicknesses of paper. There are other minor features which make this machine very useful and practical for perforating stencils. It is the subject of a patent and is manufactured by Mr. Julius Sternfeld, No. 125 East Twenty-third Street, New York, from whom further particulars may be obtained.

TRAVELING FREIGHT RAMPS.

Those who are engaged in transferring freight to or from vessels will, without doubt, find interest in a description of a somewhat recently devised ramp for the economical and rapid performance of this work. The device is an adjustable and moving section of the pier, of which it forms a part. The different conditions at different harbors are met by ramps, not alike in all respects, but the characteristic features of the machine will be found in the six installed for the Northern Steamship Company, at Buffalo, N. Y., one of which is represented in the accompanying illustration. Each of these ramps is made up of a moving part and a stationary gangway, the former consisting of an endless apron composed of metal-covered planks attached to two strands of chain running around head and foot wheels, the upper and lower runs of this carrying apron being supported by small flanged rollers traveling on T-rail tracks. At either side of the foot of the moving portion an arm projects with a number of recesses for the reception of the brow-plate which connects the ramp with the vessel. The machine is pivoted at its inboard end, so that, by means of hoisting gear and counterweights, the outboard end may be swung to and locked in any position within 20° above or 20° below the horizontal plane, these inclinations representing the extremes of the various heights of the ports of the vessels to be loaded or unloaded.

Our illustration represents one of these machines at work unloading freight from a point below the level of the pier. The operation is as follows: The ramp having been swung to the proper position and the brow-plate having been adjusted so as to form a tangent plane from the carrier to a loaded car or deck of a vessel, the men are enabled to push their loads to the moving apron without shock. If the freight is on trucks, their wheels are allowed to rest in the recesses formed by the metal-covered planks, and the men are thus freed of their burdens until they reach the inboard end of the ramp, where they unload and then return with the trucks down the stationary gangway.

The machines at the Northern Steamship Company's pier are about 25 feet long, are run at a speed of 108 feet per minute, are reversible, so that they will carry freight to or from the vessel or car, and are compactly constructed. Each ramp is operated by a 5½ horse power alternating current motor, placed between the upper and lower runs of the apron. The carrier is readily started and stopped by means of a friction clutch, and after being stopped, is prevented from running down the incline by a brake.

The ramp dispenses with the extra men required to take freight up an incline; the labor of those who work in connection with it is made light, and in rapidly loading or unloading freight it reduces the time of the vessel's detention at the wharf, and so enables the pier to unload a greater number of vessels in a given period.

The traveling ramps referred to were designed and installed by The Link-Belt Engineering Company, of Philadelphia and New York, and The Link-Belt Machinery Company, of Chicago and New Orleans.

FREIGHT RAMP IN OPERATION.

Fire Losses for 1897.

The Chronicle fire tables for 1898 give information in regard to the fire losses and insurance losses for the year 1897. The aggregate fire loss was $2,454,592,481, which is $2,382,845 less than in 1896. The insurance loss for the year was $1,438,902,448, or $7,181,655 lower than the loss for the previous year. This showing is smaller than for any year since 1890. A noticeable feature is that for the first time the yearly loss of New York was exceeded by that of another State, Pennsylvania leading with a fire loss of $13,706,315 and an insurance loss of $8,674,980.

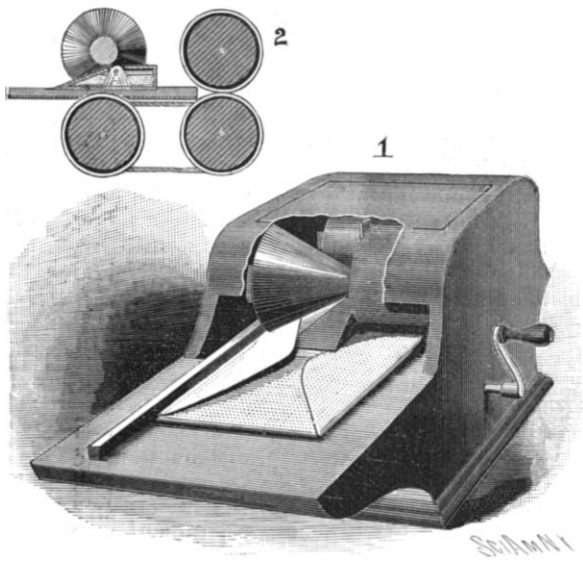
The number of fires reported during the year was 55,779, of which but two caused a loss of over $1,000,000. One was at Knoxville, Tenn., in April, where the figures footed up to $1,019,725, and the other was at Pittsburg, Pa., in May, when the loss was $1,905,515. The loss to the State of Pennsylvania on the buildings at Harrisburg aggregated $700,000. The greatest monthly loss occurred in January, when the property loss was $11,594,495 and the insurance loss $7,187,515.

There were burned in 1897, 33,033 dwellings and tenements; 11,811 barns, stables, and granaries; 1,753 general merchandise stores, 913 retail liquor stores and saloons, and 735 churches.

A NOVEL ENVELOP MOISTENER AND SEALER.

The illustration which we present herewith represents an improved moistener and sealer, designed to facilitate the work of sealing envelops. The apparatus has been patented by H. A. Thexton, of St. Thomas, North Dakota.

Referring to our illustrations, it will be seen that



THEXTON'S ENVELOP MOISTENER AND SEALER.

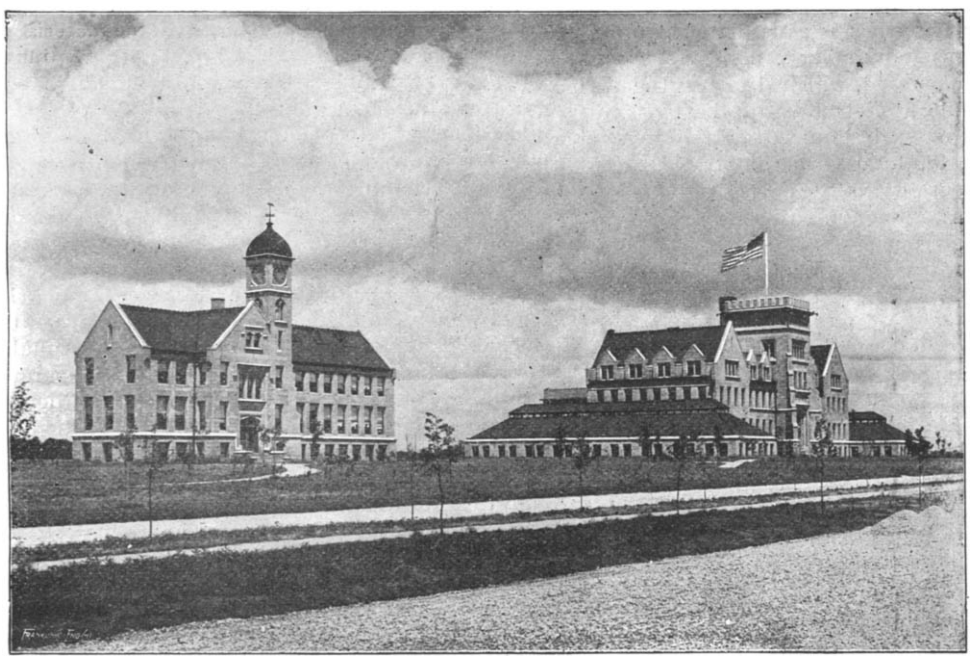
the device comprises two pairs of rollers mounted in a frame. These rollers are covered with a layer of rubber and a layer of felt. The lower layer of rubber provides elasticity and the upper layer of felt absorbs any unnecessary moisture. The two lower rollers, as shown in Fig. 2, are connected by a belt. A crank-arm and shaft are attached to the lower forward roller. The upper forward roller is formed at one end with a conical moistening section mounted above a water reservoir. A wick extends through an opening in the top of the reservoir and is designed to absorb water, and to apply it to the gummed portion of the envelop.

The envelop to be sealed is placed upon a forwardly projecting platform as indicated in Fig. 1, and is pushed forward, with its flap over the water reservoir. The envelop is fed along by the first pair of rollers, and the gummed surface is moistened by the damp wick. The second pair of rollers then receives the envelop, closes and presses the flap down and discharges the sealed envelop. The upper rollers are provided with springs, so that they shall yield under the pressure of an exceedingly thick envelop. The device is especially adapted for use in large commercial establishments where many letters are daily mailed.

In France the annual consumption of matches is about 900 per head of the population. About 33,000,000 matches were made in France in 1897 and about 45,500,000 were imported. The state has a monopoly for the sale of matches and tobacco. The sale of matches in 1897 brought a profit of about $4,000,000, and the tobacco monopoly a net income of $65,000,000.—La Vie Scientifique.

THE BRADLEY POLYTECHNIC INSTITUTE AND SCHOOL OF HOROLOGY.

Polytechnic institutes are by no means uncommon in these latter days of the nineteenth century, and have made a decided impress upon the youth of the last two generations. The Bradley Institute, however, located in Peoria, Illinois, presents at least one unique feature, in that it has a department devoted to horology, one entire building being wholly given to instruction in this art.



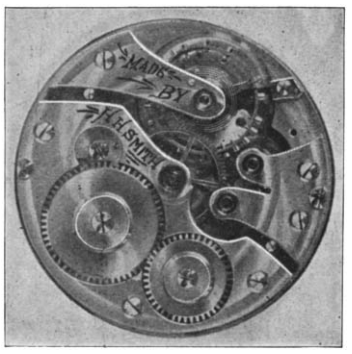
GENERAL VIEW OF BRADLEY POLYTECHNIC INSTITUTE.

The first horological school known in this country was instituted by Mr. J. R. Parsons some twelve years ago, steadily increasing in growth and popularity until the founding of the Bradley Polytechnic Institute, by Mrs. Lydia Bradley, in 1897, when it became a department of such institute, Mr. Parsons remaining the principal. Like the departments devoted to the arts and sciences, this school is open to both sexes; and it is said, in the finer and more expert details of mechanical work, that the lady pupils are in no way inferior to their male compeers. Here is taught, both theoretically and practically, all the minutiæ of watch and clock making, including repairing and the reproducing of parts to scale; the making, designing, and repairing of jewelry; coloring, alloying, plating, and drawing of metals; engraving and designing of patterns, crests, and monograms; likewise all the arts of the lapidary and optician. So successful has been the brief career of this school, that it is confidently expected it will shortly prove considerably more than self-sustaining. Recently, in the brief period of five weeks, a student designed, and made from the raw materials, a watch of the finest and highest grade, exhibiting the perfection of mechanical art. This is certainly an effective denial to the claim that the details of delicate mechanism in the highest grade of watches is beyond the scope of the American producer, though it has long been acknowledged, even among the Swiss that American factory-made watches are without equal in their respective classes.

The day is, perhaps, not far distant when the tables will be turned, and the United States export the finer grades of hand-made watch and clock mechanisms, instead of the same, as at present, being a considerable item among imports. But even if this should never occur, the impetus that will be given to the higher grade of mechanics, as represented by the watch, clock, and jewelry trades, by such an institution as the Bradley Horological School, will be of inestimable value. Teaching of the kind afforded must result in the gradual displacement of tinkers and half-taught tradesmen, who are now, unfortunately, too often in evidence, by a class of experts competent to judge and be judged of in their special lines of labor. In one of the engravings we show a specimen of the work done by one of the pupils of the institution. It is a thin 16 size pocket chronometer, nickel plates, gold wheels, raised gold settings, with seventeen pigeon blood rubies, stem and pendant setting of the Institute's design, the movement is handsomely finished and adjusted to isochronism; heat, cold, and six positions.

The wheels and pinions were all cut on an ordinary watchmaker's lathe with the aid of Parsons' wheel cutter.

Returning to the institute as a whole, it may be added it is fitted up in the most thorough and complete manner, and the instruction is of the most practical and helpful character. Aside from history, the languages—both modern and "dead"—and mathematics, all forms and grades of mechanical and decorative art, are taught. Large and roomy workshops and perfectly equipped laboratories invite the students to special lines of study and development. In the biological department are aquaria, an herbarium, and all the facilities for the preservation and study of the lower forms of life, animal and vegetable, in natural surroundings and under normal conditions, in connection with such aids as are afforded by microscopes, dissecting models, charts, manikins, etc., all the essentials in fact for laying a firm foundation in zoology and botany. The same completeness likewise obtains to the laboratories devoted to physics and chemistry. Here is everything necessary to the investigation of the processes of heat, light, sound, electricity, crystallization, and analytical research — even photography is taught. A steam engine and dynamos furnish light and ventilation besides motive power in the shops devoted to wood and metal working in all their branches. And still another feature is the department of domestic economy, wherein is taught sewing, cutting, fitting, mending, housewifery, etc. Even the kitchen is so complete in its furnishings and curriculum as to fairly deserve to be classed as a laboratory.



SPECIMEN OF WORK BY ONE OF THE PUPILS.

INSTITUTE FOR EDUCATING WATCHMAKERS—PRIMARY DEPARTMENT.

FINISHING AND ENGRAVING DEPARTMENT—HOROLOGICAL INSTITUTE.

Certainly there is a bright and practical future for institutes of this character.

New Petroleum Discovery.

A new source of petroleum has been found in the Western Caucasus, not far from the shores of the Black Sea. The oil occurs in large quantity, and the importance of the discovery for European consumers consists in the fact that, as compared with Russian petroleum, the long journey between Baku and Batoum will be saved. The right of exploitation is in the hands of a Moscow capitalist.

Science Notes.

According to M. Bergmann, graphite can be obtained by heating to 150° Cent., and under a pressure of five atmospheres, acetylene gas with oxygenated water. The same result is obtained by bringing calcium carbide in contact with water and treating the mass with diluted hydrochloric acid.

The State of Pennsylvania is one of the few which has taken any practical steps toward forest preservation under a law which went into effect on January 1 of this year. The State forest commissioners are authorized to purchase on behalf of the State land suitable for forest culture and so located as to protect watersheds. Under this law Commissioner Rothrock recently purchased 14,000 acres of land in Clinton County, at tax sale, at an average cost of 8½ cents an acre.

The first volume of a second edition of a useful directory of German makers of optical instruments, and other instruments of precision, has been published by the firm of F. & M. Harrwitz, Berlin. This "Adressbuch" is edited by Herr F. Harrwitz, the editor of the journal Der Mechaniker, and has been greatly enlarged. It contains the names and addresses of German mechanicians, opticians, glass instrument makers, and allied callings, arranged alphabetically according to names of firms, towns, and specialties. How numerous these makers of scientific instruments are in Germany, says Nature, may be judged from the fact that the directory just issued contains nearly four hundred pages.

A. Haddon has studied the passage of certain salts used in photography through gelatin septa. He finds that sodium hyposulphite dialyzes more rapidly through a septum tanned with oxidized pyrogallic acid than through plain gelatin, and that gelatin hardened with chrome alum allows least salt to pass through. Potassium bromide passes at the same rate, whatever the state of the gelatin; sodium carbonate resembles the hyposulphite in its action; sodium sulphite passes most rapidly through plain gelatin, and least through that treated with chrome alum; mercuric chloride resembles sodium hyposulphite; and pyrogallic acid passes most rapidly through gelatin hardened with chrome alum, plain gelatin coming next in order.—Photo. Journal, xxii., 224.

From the Chemical Laboratory of the University of Virginia we learn of a very simple and satisfactory method of distinguishing stucco work made in Keene's cement from that made in ordinary plaster of Paris. As is well known, Keene's cement is characterized by the presence of a small amount of alum. It is ascertained that the alumina, which is present to the extent of less than one per cent, is to be detected by a dilute infusion of logwood, which need merely be applied by a feather or camel's hair pencil to the surface of the stucco, when almost immediately the blue violet color of the spot will indicate Keene's cement; while ordinary plaster of Paris is merely stained a reddish brown under this treatment. In the supervision of certain work this test applied in an inconspicuous place will solve what might otherwise prove a troublesome problem for an analytical chemist.

A paper by Messrs. Edwin Edser and C. P. Butler, on "A Simple Method of Reducing Prismatic Spectra," was read by Mr. Edser at the late meeting of the Physical Society. The production of interference bands in a continuous spectrum is capable of furnishing a reference spectrum which can be employed to determine the wave lengths corresponding to the bright lines in a spectrum of a metal or a gas. The authors discuss various methods by which such bands can be formed. In their final experiments, an air film between two plane parallel glass plates is inserted in front of the slit of the spectrometer, in the path of the incident light. Owing to the interference of the direct ray with that twice internally reflected, bright bands separated by dark intervals are observed in the spectrum; these bright bands correspond to a series of different waves, whose lengths are easily determined for the whole series, when two of them are known. The bands are much improved by partial silvering of the two internal surfaces of the glass. It has been found that ordinary plate glass, if well chosen, is good enough for all these experiments. In order to adjust for parallelism, a spot of light, or the filament of a glow lamp, is viewed through the silvered surfaces. A long train of images is generally visible; these must be brought into coincidence. If now a sodium flame is looked at through the film, interference bands are seen. These bands must be adjusted by pressure, to be as broad as possible. An arc lamp is used for illuminating the collimator slit. The authors exhibited the apparatus, and showed photographs of spectra scales, with the appropriate wave lengths calibrated upon them by this method. The results obtained were read from the spectrometer to 0·4 of a tenth-meter, with an ordinary pocket lens. A simple graphic method enables wave lengths, corresponding to a great number of spectral lines, easily to be determined by inspection. The phase changes introduced by the silver do not affect the final result.

Miscellaneous Notes and Receipts.

German authorities report the astonishing fact that in Germany and Switzerland 2,000,000 glass eyes are annually manufactured, while one French factory is turning out as many as 300,000.—Technische Berichte.

Composition for Fire Extinguishers.—As is well known, the effect of these apparatus consists in that the liquid contained in the extinguisher is caused to evaporate quickly by the fire, whereby a large quantity of gas free from oxygen is generated, which displaces the air, thus extinguishing the fire. One of the best recipes for the composition of such liquids is given by M. Raymond, viz.: Water, 1,000 parts; borax, 40 to 60 parts; soda (anhydrous), 80 to 120 parts; sodium hydrate, 150 to 200 parts; ammonium carbonate, 75 to 100 parts; ammonium chloride, 200 to 280 parts.—Alkohol.

Asbestos Leather.—A German inventor has obtained an English patent for an improved asbestos stuff—asbestos leather—and its mode of manufacture. The asbestos is divided into very fine fibers of the greatest possible length, then immersed into an India rubber solution; the whole is next thoroughly intermixed, until every fiber is coated with the solution. The solvent, for instance, petroleum benzine, is thereupon evaporated. The asbestos fibers then cohere perfectly, and the mass may be pressed into any desired form or may be rolled. The inventor calls the manufactured product "asbestos leather," and it is said to resemble very closely leather in its peculiarities and structure.—Zeugdrucker Zeitung.

Gum Euphorbium.—In gathering this gum resin, used in medicine since olden times, the natives of Natal observed, latterly, that the knives employed for cutting into and scratching the plants became covered with a very firmly adhering coating of the gum resin, which protected the knife blades perfectly from all formation of rust. The government took the matter in hand, and it was found that even iron objects sunk in sea water were preserved entirely free from rust for two years by this coating. According to these experiments instituted at Chatham, an alcoholic extract (instead of the shellac heretofore used for the purpose) would be the best means of protecting metal ware and instruments from rust. A coating applied to wooden ware, beams, and other objects exposed to attacks by termites is said to protect same entirely from these destructive insects. In bruising the extremely sharp gum resin great caution is necessary, since the dust entering eyes and nose causes violent inflammation of these organs.—Staats Zeitung.

To determine whether a trunk was hewn in winter or in summer is of the greatest importance to buyers of timber, especially as regards building timber, since it is well known that timber cut down in summer represents a lower value than that felled in winter. Timber hewn during the resting period, i. e., between October and April, contains in its cells numerous starch particles which cannot be found in wood cut down in summer. Owing to this presence of starch the wood is coarse and impenetrable, since the starch closes the pores. For this reason, winter-hewn timber is exclusively employed for staves because, with staves from summer-hewn wood, the contents of the barrels are subject to evaporation through the pores. The starch contained in the winter wood is given a violet color by iodine. Hence, if the timber to be examined is coated with an iodine solution and the surface of the felling side appears yellow, it may be assumed with certainty that the respective tree was cut down in summer. The light yellow lines are the moisture rays, while cells, tissue, and wood fibers simply take on a yellow coloring. In the case of winter-hewn timber the amylaceous rays form much darker, ink-colored, black stripes on the yellow ground.—Allgemeine Tischler Zeitung.

Green guttapercha is now produced from the leaves of the caoutchouc tree, and is said not only to possess all the advantages of the article obtained by incision into the stem, but even to excel it in durability, so that it can enter into use industrially and commercially in a hitherto unknown way. It is readily prepared and cheap in price, not requiring an expensive purification, which heretofore increased the price of the product 15 to 25 per cent. Besides, it is highly plastic, very strong, can be divided into the thinnest leaves and receives the most delicate and at the same time most distinct impressions, by moulding and pressing. Moreover, it withstands the action of water and the strongest acids, and even in a worn and broken-up condition is still worth 25 per cent of its cost of production. The French mail and telegraph department has already commenced its use for the construction of submarine cables.

Schweinfurth, by the way, is said to have discovered in Central Africa a tree, called "tsofar" by the natives, from which also exudes a gum already introduced in commerce. This tree possesses the remarkable quality of giving off flute-like sounds when the wind blows through its branches. These are caused by an insect penetrating into the wood, in order to obtain the gummous substance, thus transforming the tree into a huge Pan flute.—Technische Berichte.

Slag Bricks in Germany.

F. W. Luermann, in an interesting article in Stahl und Eisen, gives his experience in the manufacture of bricks from granulated blast furnace slag, says United States Consul Max Bouchsein.

The direct production of building and paving stone from fluid slag, he says, is nothing new. Such slag bricks, however, did not prove a suitable material for dwelling houses, because they are, like glass, impermeable for air as well as steam. In human habitations, the aqueous vapor exhaled by the occupants would condense on cold days on both windows and walls, thus rendering the rooms damp and unhealthy. On the other hand, brick manufactured from granulated blast furnace slag is permeable and hygroscopical—that is, both air and steam can penetrate them.

The first one to produce granulated slag or slag gravel for brick making, by passing the fluid slag through water, was Eugene Langen, an employe of the Friedrichs Wilhelm mine, near Siegberg, Westphalia. This process causes disintegration; silica is separated in a soluble condition, in which it easily hardens in the air and combines just as easily with caustic lime. The single grains of the slag gravel, when compressed tightly, are bound by the soluble silica; and when ground to a fine dust, so that the particles come into closer contact with each other, the binding by the silica therein is sufficient for the production of good building bricks. Bricks from ground slag, however, require a longer time for hardening than those manufactured from granulated slag. By mixing granulated slag with dust from slag which has crumbled in the air, good bricks can be produced without any addition of lime; but the hardening process is rather slow. Hardening takes place quickest in from six to eight days with bricks to which about 10 per cent of burned and slaked lime has been added.

Granulated slag, from its passage through water, contains from 19 to 33 per cent of water, according to its porosity—a fact which has to be considered in shipping. Its weight ranges between 1,100 and 1,500 pounds per cubic meter (35·3 cubic feet); that of ground slag runs as high as 2,900 pounds. Ground slag can be added to the mixture of granulated slag and lime when dense and strong bricks are to be produced.

The bricks may be given any shape desired; and they will preserve this shape, because they are not burned. They show sharp edges and smooth surfaces, and give the best satisfaction when as little mortar as possible is used. The natural color of slag bricks is that of grayish white sandstone. The weight ranges, according to dryness and slag used, between 6½ and 7 pounds, or about 6,000 bricks to a 20-ton car.

The strength of slag bricks fully equals that of ordinary burned bricks; 24 to 28 pounds per square centimeter (1·55 square inches) is usually considered the highest admissible burden for ordinary bricks. Well hardened slag bricks can withstand, theoretically, burdens up to 160 and 180 pounds. The resistance of slag bricks to high temperature is quite remarkable. Heated to a pale red, when the carbonate of lime begins to decompose, its strength will not be injured. Even if a part of the lime should be decomposed at such a high temperature, and thus rendered caustic, carbonic acid is again absorbed at a lower temperature, and the brick again becomes as strong as it was before. For the construction of chimneys and stacks, slag bricks are used with advantage, as the products ascending contain a large quantity of free carbonic acid, which is delivered to the bricks. For the same reasons, it is well adapted for lining lime kilns and walling in boilers.

Slag bricks are five times as permeable as ordinary burned bricks. Pressure being equal, 10¾ square feet of lightly burned bricks permit in one minute the passage of 23·3 liters of air; slag bricks permit the passage of from 101·2 to 113·4 liters. Their porosity also is greater than that of burned bricks; while they do not absorb water as quickly as burned bricks, they regain their permeability quicker than the latter. A burned brick filled up its pores with water in twelve hours, while a slag brick required one hundred and ninety hours to get thoroughly soaked.

To test whether slag bricks have dried and hardened sufficiently to be safely used, a small piece of brick tied to a string is dipped into a cold concentrated solution of sulphate of soda, and hung up at any place in a room. By the evaporation of the water in the solution and the crystallization of the soda, which in its action resembles the formation of ice, bricks that will not resist frost are destroyed, each crystal needle carrying a little cap of the material from which the brick was produced. Not slag bricks alone, but any other, can be tested in the above mentioned manner as to their power of resistance to frost.

It is said that slag originating from puddling and Thomas pig iron produces the best bricks, while Bessemer and foundry slag ranks second. The erection of a slag brick plant in connection with a blast furnace would cost about $5,000. At several German works the cost of production of 1,000 bricks is only 10 marks ($2.38). From 6,000 to 7,000 pounds of granulated slag and 450 to 700 pounds of burned lime are required for the production of 1,000 bricks.

Variety of the Typewriters.

The typewriter is one American product which has never suffered a foreign boycott.

The click of the American typewriter is heard around the world. The tourist finds it turning up in all sorts of out-of-the-way corners, from Iceland to Van Dieman's Land. With the Dongola and Ashanti expeditions it has penetrated into the heart of the African wilderness; with Lieut. Peary, it found its way to the Arctic regions; the Russian government has sent it all through Siberia; it is to be found in the homes of the missionaries in India. The Czar of Russia has a richly engraved, gold-plated, white enameled, ivory-keyed typewriter for writing both English and Russian. Queen Victoria has one in her household, and so have the Queen Regent of Spain and the Khedive of Egypt. In the wreck of the battleship "Maine" was found a typewriter, and should the Russian Eastern squadron's flagship suddenly sink in the Yellow Sea, an American typewriter would be found in the captain's cabin.

The universal use of the typewriter is due to its easy adaptation to almost any language capable of being printed. Typewriters have been made to write Greek, German, Hebrew, Siamese, Telegu, and Russian. The accents, so important a part of other languages than English, are written with dead keys, which do not move the cylinder carrying the paper. The dead key device has recently been ingeniously applied in solving a difficult problem in typewriter construction. An English missionary in India, Dr. Jacob Chamberlain, at Madanapalle, Madras Presidency, wishing to translate the Scriptures for the natives, wrote to an American typewriter company asking if a typewriter could be made to write the Telegu language. He had been using an English-writing typewriter, and one day, when it was smashed by plaster falling in his bungalow, the idea of a Telegu typewriter occurred to him. The Telegu language is peculiar in that every character represents a syllable. The missionary resolved the language into 240 characters, but upon further study found that these characters were built up from a much smaller number of basic forms. These forms were hand-cut in India under the missionary's direction and sent to the typewriter company. With the aid of the dead keys it was found possible to build up all the composite characters of the Telegu language upon a standard keyboard. The typewritten words look like a Chinese laundryman's efforts, a confused mass of curlycues, spots, points, and assorted crescents. The missionary found his Telegu typewriter so valuable in Christianizing the heathens that other missionaries sent orders for similar machines. With them a large portion of the Bible has been distributed in duplicate among the natives.

An English student of Hebrew sent an inquiry to the same company for a Hebrew typewriter. None had ever been made, but a Hebrew keyboard was planned and the order filled. Hebrew, it must be remembered, is written from right to left. The Hebrew typewriter made for the student has the mechanism of the ordinary typewriter; to have reversed it would have been a costly undertaking. The owner consequently has to write backward. Should there be a sufficient demand for Hebrew typewriters, they would be made from the upper righthand corner to the opposite. The German government recently ordered the use of only German letters in the government business. For several years German typewriters with Roman letters have been in use, but to meet the new order a German letter keyboard has been arranged. A change has also just been made in the Greek typewriters. The first Greek typewriter wrote a slanting letter, but a new vertical letter having become much in favor in Athens, an American typewriter company has equipped a machine with this style of type.

King Chulalongkorn I. of Siam, while traveling in Europe not long ago, first saw the typewriter. He was so interested in the machine that he immediately gave command that a typewriter be added to the equipment of the royal household. The Siamese language had never been written with a typewriter, but an American typewriter company was appealed to, and within a short time the King was supplied with a Siamese typewriter. His northern neighbor, the Emperor of China, might use a typewriter if he had one, but until he publishes an imperial decree abolishing 14,000 odd characters of his people's alphabet he will have to content himself with a brush and inkpot. The Japanese, in their struggle for commercial recognition, are crying for typewriters. Experts are at work unraveling the Japanese language, and a Japanese typewriter keyboard will probably result from their study.

The polyglot machine is a recent development of typewriter construction, says The New York Sun. Business houses doing a large foreign business with several countries ask for machines writing several languages. By providing for the accents of the various European languages on one keyboard, half a dozen or more languages may be written on one machine. Many typewriters with English-Spanish-French keyboards are shipped to South American countries. The most interesting polyglot machine in the world is one just sent to Pope Leo XIII. for use in the Vatican. Like the one furnished the Czar, it is decorated with gold, ivory, and enamel. The machine writes English, French, Italian, Spanish, Portuguese, and German.

Covering the Waste Places with Grasses.

All our extensive ocean front, where fashionable summer cottages have been erected, is now fringed with green lawns, and where before nothing but dazzlingly white sandy beaches fronted the sea, fine silky grasses flourish, offering a pleasant contrast to the narrow strip of land which the waves leave bare as the tide recedes. One of the chief objections to a residence by the seashore has been removed in recent years by the successful cultivation of green grass on the barren strips of glaring beaches, and with proper foresight one may surround his home abutting on the sea with all the green verdure that is pleasing to the eye. The introduction of the Japanese lawn grass for seaside lawns marked the beginning of this change for the better, and though a frail and apparently delicate grass, it holds its own against the salt-laden winds, and gradually binds the sand together so compactly that the waves have difficulty in washing it away.

This is a fair illustration of the benefits obtained in this country in recent years in the study of grasses, both by the Department of Agriculture and at the State Experiment Stations; but if it is a good illustration, it will be seen that it is only one of many similar cases that can be mentioned. From Maine to Florida, seaside property is becoming more valuable each year in proportion to the ability of man to shut out the sea from encroachment. While expensive jetties, bulwarks, and piers have been built to save the land, the small sand-binding grasses are often found to be more effective in the end. Destructive sand storms make certain parts of the coast uninhabitable, and they sweep over the beaches with such power that they kill every particle of vegetation. At Cape Cod these sand storms are the most destructive on the Atlantic coast, and more than once in the history of the place they have threatened Provincetown so that the citizens had to turn out to protect their property. The culture of soil-binding grasses has received so much encouragement through the Department of Agriculture that it has become pretty general along the Atlantic coast, and millions of dollars' worth of property will be saved for the future.

The sea lyme grass is recommended for the Atlantic coast north of Massachusetts, but south of that point the sand reed or marram grass is better adapted to the work of holding the sand and soil threatened by the water. Below Virginia the bitter panic grass is the best soil binder, and it extends all down the southern coast, and even around on the gulf side of Florida. The creeping panic grass is another soil binder, found chiefly near St. Augustine, Florida. For inland bays, rivers, and canals the common salt grass is of inestimable value. The rolling spinifex of Australia and New Zealand is an imported variety of grass that has a promising future in this country. Besides binding the sand together, this grass is remarkable for its rapid possession of new territory. The seeds are scattered by the winds over all adjacent beaches, and in a few seasons they grow up and reproduce their kind.

While soil-binding and seaside grasses have performed a great work in the improvement of this country in the last ten years, their usefulness is after all secondary to that of the pasture and hay grasses. The foundation of all good farming is grass. A land rich in succulent grass can be turned into a great cattle and stock raising region or into a successful farming community. A territory covered with heavy masses of grass has a rich, fertile soil, and conversely luxuriant growths of grass will convert a poor soil into a fruitful, productive land.

But only certain favored regions of this country were covered with rich grasses. Wild grasses that have since been brought under cultivation and greatly improved were prolific in different territories, but they failed to produce sufficient crops either to support cattle or to make farming profitable. Still other regions were almost totally destitute of anything that resembled nutritious grasses, and agriculture has been the most backward in those places. It has been the work of modern science to introduce cultivated grasses where they could benefit the country, and to select the best wild varieties and improve them by cultivation.

It should be remembered that all of our cultivated grasses were once wild—our timothy, red top, orchard, and Kentucky blue—and that not such a long time ago. Timothy grass is less than one hundred and fifty years old as a cultivated grass, and about the same time orchard, red top, and Kentucky blue grasses were redeemed from their wild state to take a place in our fields and orchards. Prior to this period they were all as wild as our Western buffalo grass, grama, or the wheat grass of the plains. What they are to-day, and what important bearing they have upon the agricultural resources of the country, can probably be appreciated by anybody at all familiar with the cattle and stock raising business of the United States.

Experiments with grasses have been going on continually by experts for the past ten years, and the results accomplished are little short of the marvelous. Enormous areas of the South are being developed, and their agricultural possibilities enlarged, by the grasses that have been planted there. Cattle raising as well as general farming have advanced in the South along with grass growing. Large regions that seemed to be unfit for almost any kind of vegetation are now producing an abundance of special grasses, which give support to sheep, swine, and cattle.

The United States Department of Agriculture has at present a grass farm established at Knoxville, Tennessee, where over one hundred and fifty kinds of grasses and forage plants are cultivated for the purpose of introducing to the farmers the most suitable varieties for their special localities. Grasses adapted to sandy soil, to upland districts, and to the wet lowlands are all raised carefully under conditions that will test their virtues thoroughly before they are recommended to the general farmer. Some of the grasses that are thus being introduced in the South are foreign varieties, and others are native grasses obtained chiefly from the prairie and Rocky Mountain regions.

In testing the value of wild grasses, it is first ascertained if they are adapted to the localities in which it is proposed to raise them. It has been found time and again that some of our most important grasses grow wild in an enfeebled condition, but when given good cultivation they quickly improve and assume a rampant growth. Other wild sorts have a sturdy growth, but their relative innutritiousness makes it unwise to cultivate them. Other nutritious grasses have to be condemned simply because their seeds are difficult to harvest, especially if their seed production cannot be improved. Just at present dry land grasses are much needed, and efforts are being made to produce more and better growths of this kind.

Some of the wild grasses that offer little returns to the farmers to-day are under cultivation at the experiment station, and it is expected that in the next generation they will fill a long felt want. Chief among these promising varieties are the common switch grass, the Western big blue stem, the bushy blue stem, mountain timothy, wild ribbon grass, large bent grass, wild June grass, buffalo bunch grass, and wheat grass. Two native winter pasture grasses from the Southwest have been found to be of special value in the South. The Apache timothy of New Mexico promises to flourish vigorously throughout the South to supply cattlemen with winter pasture for their flocks. The Tennessee fescue is another excellent grass for the South that has been brought down from the mountain regions of Tennessee and North Carolina. The sheep's fescue from Montana has also added to the list of available Southern grasses. Texas blue grass flourishes throughout the Southern States, and its seeds are now being planted from one end of the South to the other.

Of imported grasses, the meadow foxtail makes one of the best pasture grasses, and it is now raised in this country as extensively as in Europe. The true English blue grass and the European reed fescue are also adapted to many parts of this country. Africa has contributed a new grass, which is known as "teff," and it has been cultivated with great success in Florida. As it comes from a warm country, it makes an excellent growth right through the hot summers of the South. When raised successfully, it produces enormous crops of grass or hay.

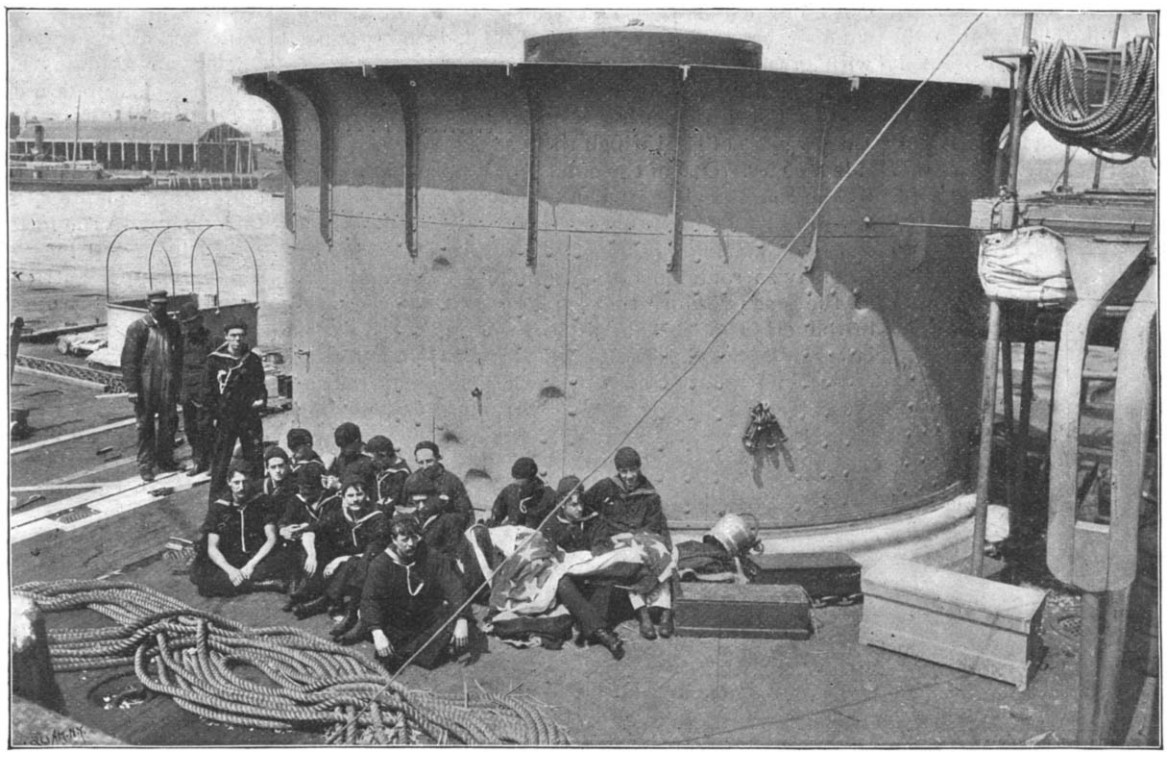
The most marvelous crops, however, have been obtained from teosinte, a vigorous plant that grows like Indian corn, and in tropical Florida it reaches an enormous height. As many as fifty to sixty stalks have been known to spring from a single seed. The sowing is in drills, and not broadcast, and when it has the right soil it produces an enormous amount of green food. It is a tropical plant, and it does not ripen in this country outside of Florida, but it will produce an abundance of green food in almost any of our States, especially in the South. As a forage plant this will probably be a great favorite in the future.

Besides summer and winter pasture grasses, various forage plants, that are not grasses at all, have been cultivated in recent years, and Southern farming has been largely revolutionized by them. Probably the most important are the cow pease and the soy beans. These plants are vigorous growers, and derive most of their nitrogen from the air. They belong to the leguminous family, and they enrich the land by adding large quantities of nitrogen to the soil. Nitrogen is a valuable and important fertilizer that must be added to the soil directly or indirectly, and the leguminous plants do this work better than any artificial method. They are the best soil renovators and soil enrichers that we have, and chief among them are the soy beans and the cow pease, which are now raised so extensively throughout the whole South. G. E. W.

THE resistance of glass varies widely with temperature, says The American Electrician. If taken at unity at 68° F., the resistance is 0·077 at 142° and 87 at 0°. At the latter temperature glass has a resistivity of 5,000 million million times that of copper.

ERICSSON'S COAST-DEFENSE MONITOR "NAHANT."

The old coast-defense monitor "Nahant," which has been doing duty during the war as one of the guardians of New York Harbor, is one of the most interesting legacies of the civil war. Her shot-indented turrets alone entitle her to "honorable mention," and it is no small tribute to the merit of her design and the excellent work that was put into the vessel by her constructors that now, after being afloat for nearly forty years, she should be capable of making the deep sea voyage from the Delaware to New York and taking an active part in the defense of the harbor. Historically, it would be impossible to find a vessel, much less a whole group of vessels, which, in this present age of warship construction, is entitled to more profound respect than the "Nahant" and the other twelve ships of the class to which she belongs.

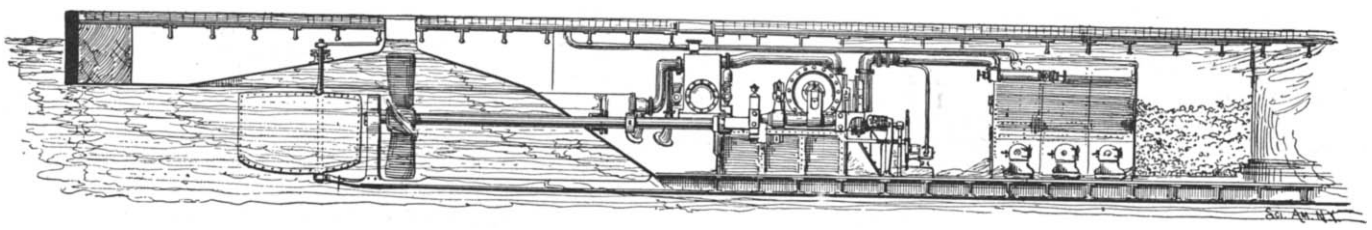


TURRET OF THE "NAHANT," SHOWING SHOT HOLES RECEIVED DURING BOMBARDMENTS OF THE CIVIL WAR.

The story of the "Merrimac" and the "Monitor" is too familiar to bear repetition here; it must suffice to say that to oppose the formidable powers of the Confederate ship "Merrimac" demanded something entirely different from the wooden frigates that were then doing duty in the South. To Ericsson was intrusted the task of building a war vessel that could oppose armor to armor, heavy gun to heavy gun, and overmatch the novel and greatly dreaded craft in a square stand-up fight upon the sea. The "Monitor" was built, hurried to Hampton Roads, and met and checked the "Merrimac" while the latter was in the very act of sinking the unarmored Northern vessels. The "Monitor" marked the decisive turning point in the construction of modern warships. We say this with full knowledge that armored vessels had been already used in the Crimean war, and that Capt. Cowles, of the English navy, had already written a treatise explaining his device for "mounting heavy guns in a revolving, armored, circular turret." Full credit is to be given both to the French and English in this respect, and even greater credit to our own Mr. Stevens, who, at an even earlier date, as far back as 1841 and 1853, had recommended and commenced the construction of an armored floating battery at New York. These earlier designs foreshadowed the coming change, and "La Gloire," of the French navy, was already afloat with a full suit of armor upon her sides; but to Ericsson's "Monitor" is due the credit of being the first war vessel in commission to combine side armor, the armored revolving turret, the armored conning tower, and engines below the water line.

Within a month after the eventful duel in Hampton Roads Congress had authorized the construction of thirteen single turret monitors. The keels were at once laid and the whole fleet was rushed to completion in time to take a very active part in the subsequent operations of the war. Eight of the monitors, including the "Nahant," were of 1,875 tons displacement and the other five were given larger dimensions, being 25 feet longer, of 2 feet 4 inches less beam, 2 feet greater draught, and half a knot more speed, with a displacement of 2,100 tons.

The leading dimensions of the "Nahant" and her class are as follows: Length, 200 feet; beam, 46 feet; draught, 11 feet 6 inches; indicated horse power, 340; speed, 5½ knots. The battery consisted originally of two 15-inch smooth-bores, but for her duties in the present war a pair of 6-pounder rapid-fire guns were added on the bridge deck, astern of the turret. The total cost of the hull and machinery was $413,575, and she was constructed by Harrison Loring, at Boston, Mass. In her general design she is very similar to the original "Monitor," and the description, "a cheese-box on a raft," fairly well describes her appearance when stripped for action. By referring to the transverse section through the turret and the longitudinal section, it will be seen that the vessel consists of a shallow hull within an inclosing raft-like structure of solid timber. The "raft" projects several feet from the hull proper along the sides, and has a great overhang fore and aft. It is formed of solid timber closely packed and securely bolted to the hull. The sides of the raft are protected for its whole depth with five 1-inch iron plates, three of the plates extending the full depth (6 feet) of the raft and the others extending to various depths, so as to present a tapering thickness of protection. The raft performs the duty of protecting the hull from shot and from the ram of the enemy.

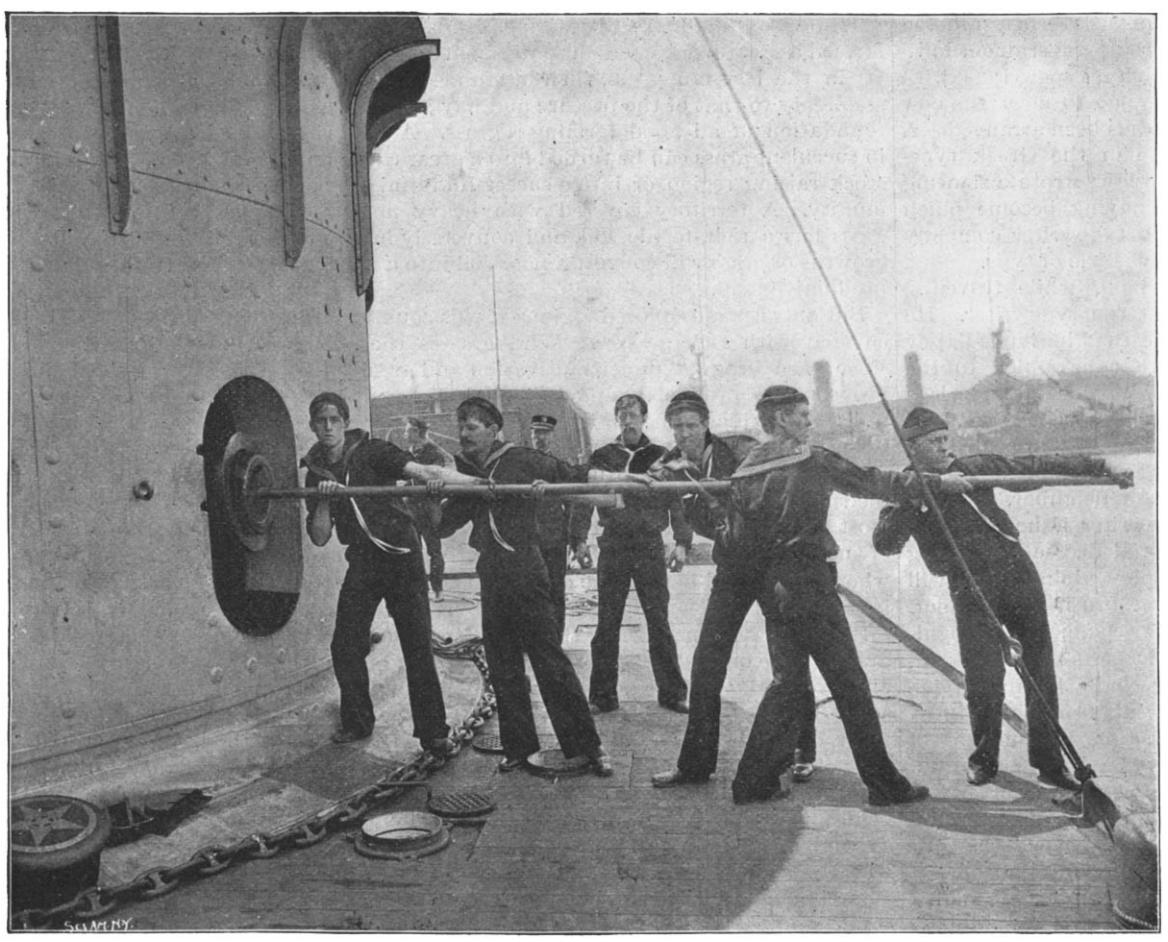


LONGITUDINAL SECTION THROUGH MONITOR "NAHANT."

The subdivision of the hull is as follows: Forward in the bows are the chain locker and the anchor engine. Then come the wardroom, the berthing space for the crew, the turret chamber, the boiler room, and the engine room. The frames are spaced 18 inches apart, and they are 18 inches deep at the keel, decreasing in depth toward the bilges. The deck consists of one thickness of 1-inch iron plating, above which is laid a deck of wood. A curious feature is the method of hoisting and stowing the anchor. It is not hauled up on the outside of the bow in the usual manner, but is drawn up into a well, formed between the overhanging bow and the hull proper. The anchor chain passes over a sheave at the top of the well and down to the hoisting engine in the chain locker. It is thus protected at all times from shell fire. The same device was used on Ericsson's first "Monitor," and the Confederate sailors were puzzled to explain how she could move up to a position and remain there stationary, apparently without casting anchor. In a similar well at the stern, protected by the overhang, are the propeller and the rudder, the latter being of the balanced type.

The most interesting feature of the "Nahant" is, of course, the turret, with its two 15-inch Rodman smooth-bores. It stands a little forward of amidships and has an arc of fire of about 190°, the forward deck included within this arc being entirely free from structures that would interfere with the fire. It was made of sufficient diameter to allow the guns to be loaded in the inboard position.

The gun crew, during an action, are chiefly located on the deck, behind the shelter of the turret. After a shell is fired the turret is turned around for loading, as shown in the accompanying engraving. The construction and general arrangements are shown in the transverse section on our front page. When the turret is not in use, it rests upon a path on the main deck; but when it is in action, it is carried and turns upon a solid vertical column of wrought iron, which extends through the axis of the turret and terminates in a hydraulic ram on the deck below. The turret is raised from the deck by a few strokes of the pump, and as soon as it is sufficiently clear to admit of its turning freely, a large iron wedge is driven in beneath the foot of the column and held in place by a nut. Rotation is effected by a spur wheel and pinion beneath the floor of the turret, driven by two steam engines. The roof is built of railroad iron laid upon a stout framing of 5 × 6 and 5 × 9 bar iron, and it is stiffened at the center over the carrying column by four 4-inch tie-rods, which run down to the lower edge of the turret, as shown



NAVAL RESERVE CREW OF "NAHANT" AT GUN DRILL.

in the engraving. Similarly the load on the column is transferred by four 4-inch rods to two box-girders, whose ends rest upon the framing of the vessel.

The pilot house which is plated with 11 inches of laminated armor is carried above the turret. It is pierced with a number of observation slits, and within it are the steering wheel and means of communication with the turret and engine room. The railing which is shown above the turret is utilized in peace times for stretching a canvas awning.

Back of the turret is a light bridge deck on which are mounted a couple of light rapid-fire guns for repelling torpedo attack. These are modern additions made when the "Nahant" was being overhauled at the opening of the war. It should be mentioned that the base of the smokestack is protected by 8 inches of armor.

The two 15-inch smooth-bores in the turret constitute the main battery of the "Nahant. They were the most formidable weapons in use during the civil war, and comparatively few of this size were carried, the largest weapons being of 11 inches caliber. They fired a spherical projectile, 35 pounds of black powder being used for firing a 250-pound shell against the unarmored portions of a ship, and a battering charge of 70 pounds with a 350-pound solid shot was used for attack on armor. They are sighted up to 2,700 yards, but the ordinary fighting range varied from a mile to 2,000 yards. Most of the fighting, indeed, was done at 1,200 yards. The shell was fired with a time fuse graduated from 3½ to 7 seconds, the time being determined by the length of fuse cut off. The destructive effects of the old spherical shot were very different from those of the modern type, the latter penetrating the armor, whereas the spherical shot racked and loosened it.

That it was not always very effective may be judged from the shot indentations on the turret and conning tower of the "Nahant," several of which are shown in our illustrations. Fifteen of these battle scars may be counted, all of which were received in the various bombardments of the war, yet the monitor appears to be none the worse for its punishment.

The recoil is controlled by a wedge supplemented by rope tackles; the guns are traversed by the rotation of the turret, and the screw shown at the breech of the guns serves to give the proper elevation. The complete operations of loading and firing one round are as follows:

1. Stop the vent with a pad carried on the hand.
2. Swab out gun with a wet sheepskin swab.
3. Insert powder charge, done up in canvas bag to fit bore of gun.
4. Ram home powder.
5. Insert projectile.
6. Ram home.
7. Insert primer at breech.
8. Swing aside the port shutters.
9. Return gun to battery.
10. Rotate gun to face the enemy.
11. Elevate gun for range.
12. Fire!

It can readily be believed that the rate of fire is slow, and, as a matter of fact, there is an interval of ten minutes between rounds.

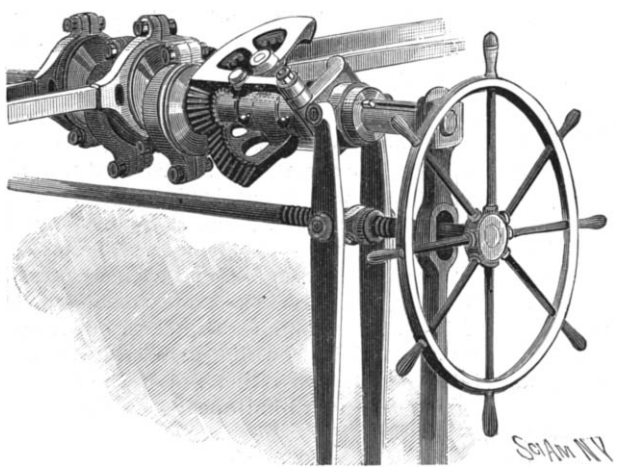
Compare this with the modern rapid-fire gun of equal or greater destructiveness which can fire ten rounds in one minute.

The port shutters above mentioned are heavy masses of wrought iron, which are swung in front of the ports after the gun was fired, to keep out the enemy's shot and shell. They are pivoted vertically, as shown in the engraving. The shutters are 9 inches thick by 2 feet wide, and completely close the gun ports.

The vessel is driven at a speed of 5½ knots an hour by an Ericsson 340 horse power two-cylinder, trunk, grasshopper engine of extremely curious construction. The two cylinders are placed back to back on a common axis, the whole being made in one casting. The diameter is 48 inches and the stroke 38 inches. Each piston connects through a trunk piston rod to a way or rocking shaft, and connecting rods transfer the motion from rocking arms at the forward ends of these rocking shafts to a common crank on the crankshaft, which is located on the axis of the vessel, the "Nahant," like all of her class, being driven by a single screw. The connecting rods consist of a cast iron center inclosed in a wrought iron strap, a gib and key serving to tighten both brasses.

Another arm on the rocking shaft serves to operate the jet condenser, as shown in the engraving.

Steam is supplied by two rectangular boilers, which represent the best practice of that day. They were built in 1862, in Boston, from designs by Ericsson. They are 11 feet wide by 11 feet high and 8 feet deep. The main shell is ⅝ inch thick. There are three furnace flues, which lead to a common combustion chamber, from which the gases return through 2-inch copper tubes to the front of the boiler, where they pass through a superheater at the base of the uptake. The original boiler pressure was 45 to 50 pounds, but only 30 pounds was used on the trip up from the Delaware to New York.



REVERSING GEAR—ENGINES OF "NAHANT."

We give an illustration of the curious reversing gear, which is carried at the forward end of the engine. The four eccentrics and the bevel wheel on the foremost eccentric are loose upon the eccentric shaft. The bevel wheel is engaged by two quadrants, one above the shaft, the other below, which turn upon pins that are carried by a collar keyed to the eccentric shaft. The effect is that the eccentrics are kept in any desired position on the shaft through the intermediary of the bevel wheel and quadrants. The quadrants are moved by means of short connecting levers which are attached to a sleeve, which is keyed loosely upon the shaft. This sleeve is attached by a loose collar to the upper end of a pair of rocking levers, which are moved by means of the reversing wheel and screw, clearly shown in the engraving. To reverse the engine, the levers with the attached sleeve would be drawn forward. The centers on which the quadrants rotate being in a fixed position relative to the shaft, the pull on the short connecting links causes the quadrants to swing across the shaft in opposite directions and turn the bevel gear and eccentrics on the shaft. It will be understood that when the engine is running, the eccentrics, quadrants, links, etc., continuously turn with the shaft.

The "Nahant" carries a full complement of 62, including the captain, executive officer, navigator, and four watch officers.

As soon as she arrived at New York, she went to the navy yard for the completion of her refitting, and then steamed to her station off Tompkinsville, her guardian duties being confined to the lower bay. Fortunately, the storm center of the war never moved so far north as New York, and the reputed speed and prowess of Admiral Cervera's ships failed to materialize. Had the Cape Verde fleet found its way to New York, the "Nahant" would have assisted the batteries and mines in repelling an attempt to rush by Sandy Hook and through the Narrows. For this work the "Nahant" could have rendered good service by firing 15-inch shells against the unprotected sides of the cruisers, supposing, of course, she was not put out of action by the Spaniards at long range—an event which their execrable gunnery would render very unlikely.

We are indebted to Capt. Richman for courtesies extended during the preparation of this article.

Discovery of a Volcanic Bomb.

In Darwin's geological observations on the volcanic islands visited during the voyage of H. M. S. "Beagle," reference is made to a "volcanic bomb" found in the interior of Australia. The specimen was composed of green obsidian, and was found on a great sandy plain between the rivers Darling and Murray, at a distance of several hundred miles from any known volcanic region. Many similar specimens of obsidian "buttons" have since been found in Australia, and The Proceedings of the Royal Society of Tasmania (1897) contains two short descriptive papers on their occurrence in Tasmania.

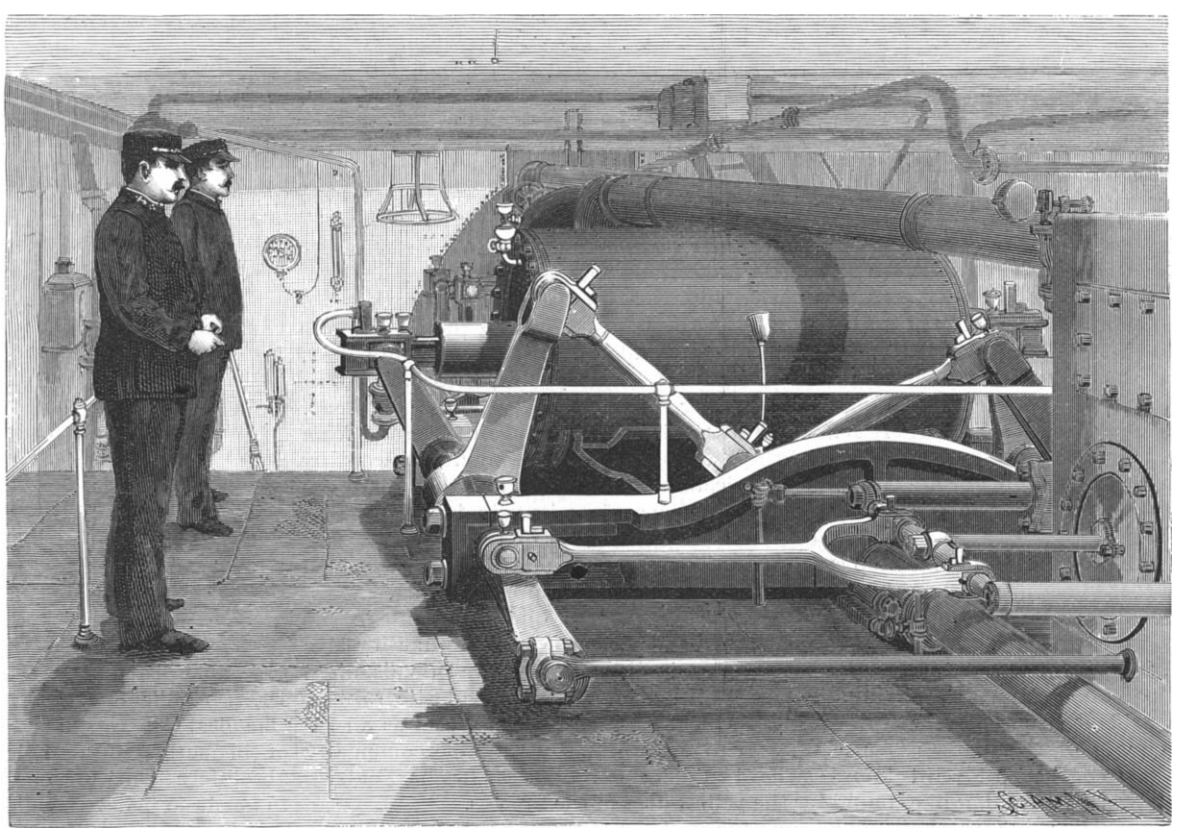
How these singular objects found their way to some of the localities in Tasmania, where their occurrence in undisturbed quartz drift far away from any known volcanic source has been reported, is unexplained. That they are volcanic products is unquestionable; and their spheroidal or discoid form points to rotation while in a fluid state. It has been suggested that the objects came from lunar volcanoes, but it is highly improbable (even if they were ejected from the moon) that they would reach our globe, and if they did, they could not penetrate the atmosphere.

Mr. T. Stephens, the author of one of the papers referred to, thinks the aborigines of Australia are probably largely responsible for the distribution of the obsidian buttons over the mud plains of Victoria and Riverina, but no such explanation can be given in reference to most of the places where they have been found in Tasmania.

In a paper by Messrs. W. H. Twelvetrees and W. F. Petterd in The Proceedings mentioned above, the suggestion is made that the objects are products of terrestrial volcanoes of an acid or sub-acid type, formerly in eruption in the southern hemisphere. The nearest known source of tertiary obsidian is New Zealand, but whether the objects have been transported through the air from that island, or from the Antarctic continent or elsewhere, it is impossible at present to decide.

A Mine Exploded by Accident.

The value of the precautions taken by the army engineers in unloading mines was amply demonstrated on August 3, at Fort Wadsworth, where a mine was accidentally exploded. In unscrewing the cap there is danger of the charge being ignited either by a spark or by heat caused by friction, for the parts are apt to be heavily rusted. To avoid casualties in case an explosion should occur, the engineers constructed a raft on which the mine was placed. A machine for unscrewing the cap was then attached and the raft floated out to a distance from shore. The machine was operated by electricity, the current being supplied from the shore. After the cap was removed, the raft was to be hauled in and the explosives taken out. Usually the device works well, but on the day named while the cap was being removed the mine exploded. It was one of the large mines which guarded the entrance to the Narrows, and when it was taken up it was found to have been badly damaged, so that extra care was taken in handling it.



THE DOUBLE-TRUNK ENGINES OF THE "NAHANT."

Diameter of cylinders, 48 inches; stroke, 38 inches; steam pressure, 45 pounds; horse power, 340.

THE ACCIDENT TO THE BROOKLYN BRIDGE.

Excessive loading of the central span of the Brooklyn Bridge, due to a blockade on the roadway, assisted possibly by extreme expansion due to the heat, caused, on the evening of July 29, a buckling of the bottom chords of the four inside stiffening trusses. The accident occurred in the main span in the neighborhood of the point marked B in the accompanying sketch diagram, or about four hundred feet from the Brooklyn tower. A similar buckling is evident at the corresponding point on the New York side.

The main features of the construction of the bridge are as follows: The floor is suspended from four 15-inch wire cables and stiffened against distortion under moving loads by six trusses. Two of these, 12 feet in depth, are placed on the extreme outside of the bridge. Next to them come the roadways, and inside the roadways are two cable roads, each of which runs between a pair of 17-foot stiffening trusses. A footway is carried between the cable roads above the center line of the bridge. These six trusses are not continuous, but are all cut and provided with slip joints at three different points in the bridge. One set of joints occurs in the center of each 900-foot shore span, and there is another set at the center of the main 1,595-foot span. The shore ends of the trusses rest upon the anchorages, and where the trusses pass through the main towers they are securely anchored to the masonry. The movement due to expansion in the trusses thus takes place from the shore anchorages outward and from the main towers toward the center of each span.

In addition to stiffening the floor by these trusses, Mr. Roebling, following a common practice of his day (since discarded), inserted in the bridge a large number of "land stays," *A A*, which are attached to the bottom chord of the trusses and tie them back to the top of the towers, where the upper ends of the stays are rigidly fastened. These were introduced for the purpose of further stiffening the floor and preventing deformation due to unequal loading. That they do prevent deformation is undoubtedly true, and not only so, but it is probable that they carry the greater part, if not all, of any moving load that comes upon that part of the bridge to which they are attached, and this, we think, is evident from the following considerations: The main cable, being capable of deflection under a moving load, and the land stays being tied to the towers, it follows that a moving load at any part of the bridge to which the land stays, *A A*, are attached, say, for instance, at *B*, will exert a pull, not in the vertical suspender that runs up to the cable, but in the diagonal land stay that runs up direct to the top of the tower. For it is a well understood fact among bridge engineers that the stresses due to a given load on a bridge or other framed structure will always find their way to the abutment or pier by the most direct route, especially if the direct course be the most rigid. Even if the effect of the load at *B* were disposed (so to speak) to exert itself by way of the vertical suspender and the main cable, the cable would instantly begin to deflect and would throw the load entirely upon the non-deflecting land stay. What is true of one stay is true of all; and if it were possible to cut all the suspenders and land stays and insert a dynamometer in each one, it would be found, we think, that practically the whole stress of a moving load, whether it was a train or a string of trolley cars, was reaching the piers by way of the diagonal land stays.

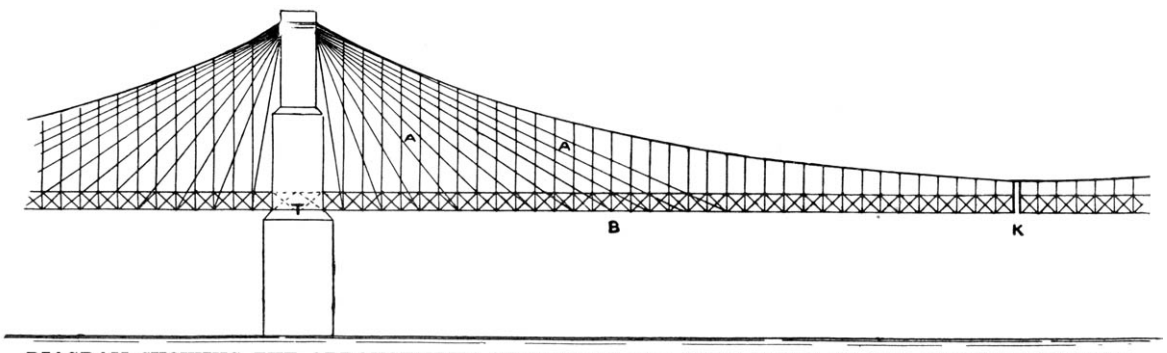


DIAGRAM SHOWING THE ARRANGEMENT OF TRUSSES AND LAND STAYS ON THE BROOKLYN BRIDGE.

Now if the bottom chords of the stiffening trusses, to which, as we have seen, the land stays are attached, were continuous, the effect would be to produce a tension in them, the land stays and chords forming a kind of secondary suspension system between the towers. But as the trusses are cut at the center and fixed at the towers, it follows that the pull of the stays compresses that portion of the chords which lies between the stays and the towers. This compression increases toward the towers, where the combined compression due to the pull of all the land stays over a distance of 500 feet has to be resisted.

It is highly improbable that provision was made for taking the compression due to the whole live load on 500 feet of the span; it is more likely that the land stays, like the stiffening trusses, were treated as subordinate features in the bridge, intended to produce a more even distribution of the load upon the main cables. That this is the case is evident from the very light sections of the bottom chords of the trusses, which, although they have been strengthened toward the towers, have not been reinforced in anything like the degree that the compressive strains due to the pull of the land stays would call for.

There is no question that the Brooklyn Bridge is carrying considerably more load than it was originally designed to do. Since it was first opened there have been added two extra tracks for the cable cars, two lines of feeder rail for the electrical equipment of the cable road, two extra cables, two tracks of 90-pound rail for the trolley cars, two lines of brackets of unusually heavy design for carrying the overhead trolley wires, a line of heavy, 8-inch, cast iron pipe for the pneumatic postal delivery, and, most serious addition of all, a line of trolley cars, many of them modern two-truck cars of extra length and weight. All this constitutes a large though not a dangerous increment in the dead and live loads over that for which the bridge was designed. While the increased loading does not materially encroach on the "factor of safety" (to use a good old term, which bridge engineers are inclined to discard), it was certain that, if there was a weak point in the construction, the additional weight would find it out.

The board of experts who investigated the question of permitting trolley cars to run on the bridge stated that it would be safe for them to do so provided that a clear space of 102 feet was maintained between cars and the speed did not exceed 7 miles an hour. These two limitations have been steadily ignored. The speed is frequently nearer 12 than 7 miles, and we have often seen the cars strung out across the bridge or bunched in sections of it with less than a car's length intervening between them. This crowding invariably occurs when there is a congestion at either end of the bridge or when any breakdown or hindrance occurs on the bridge itself.

On the occasion of the Friday evening accident, a fallen horse on the roadway occasioned a blockade in which the cars became closely bunched. It happened to be an exceptionally hot day, and there is evidence that the ends of the trusses at the crown of the bridge may have been in contact. If this did occur, the trusses being fixed at the towers formed a very flat arch, and an additional compression would thereby be set up in the chords.

The buckling is not an indication of weakness in the bridge proper, the trusses merely serving to preserve the true curve of the roadway by distributing a rolling load over a considerable length of the main cables. The occurrence is of great interest however as showing the action of the diagonal land stays under a live load. In the new East River Bridge, now under construction, these stays are omitted, and the desired end is secured by making the stiffening trusses of great depth and strength.

Shiploads of Brimstone.

Alfred S. Malcomson has published an interesting statistical table in which the world's consumption of brimstone is shown for seven years, says The New York Tribune. This commercial commodity is of great importance in many branches of manufacture, but the fact is not generally known in business circles that 118,137 tons came to the United States from Sicily in 1897, and that the year before the importation was even larger.

This commodity comes exclusively from Sicily, and to a great extent from the port of Palermo. It is shipped in bulk like coal, and looks, in its raw condition, like pieces of broken stone about the size of those which are used on macadam roads. It is a dull gray, and from that to a bright yellow, according to its quality; the higher the grade, the yellower the stone. It is handled by the large importers in its crude form only, and these dispose of it to the manufacturers, by whom it is subjected to processes which eliminate the dross and bring to the surface its valuable properties. It is used by the manufacturers of fertilizer materials and sulphuric acid, and large quantities are consumed by the manufacturers of wood pulp and paper.

The brimstone goes in great quantities also to the sulphur refiners, and after it becomes sulphur it plays an important part in the manufacture of vulcanized rubber. The addition of sulphur to plastic rubber, vulcanizing the mass between two tin sheets as an experiment, gave to the world the valuable commodity known as hard rubber; and no substitute has yet been found for the yellow dust in the process.

The brimstone statistics show that the United States receives more of the material than any other country. For the same time that 118,137 tons reached the ports of New York, Baltimore, Philadelphia, Charleston, Boston, Wilmington, and Norfolk, the following exports were made from Sicily to other parts of the world:

	Tons.
France	84,895
Italy	73,052
United Kingdom	24,520
Russia	17,532
Portugal	7,054
Germany	19,721
Austria	15,993
Greece-Turkey	13,866
Belgium	9,253
Sweden, Norway, and Denmark	11,226
Spain	4,039
Holland	3,599

The wine growing districts of Europe use large quantities of the material to destroy the insects which attack the vines, and, although many substitutes are employed, the most careful growers never abandon brimstone for that purpose.

The supply in Sicily ready for transportation is larger now than it has ever been before, there being no less than 240,367 tons in storage.

Experiments Regarding the "Setting" of Plaster of Paris.

J. A. Belcher reports (Treatment) the results of experiments undertaken to determine the effect of various agents on the "setting" of plaster of Paris: "Two drachms of plaster, mixed with one drachm of a five per cent solution of sodium chloride, hardened in two minutes. Mixed with one drachm of a five per cent solution of sugar, it hardened in three minutes and a half. Mixed with one drachm of a one per cent sodium chloride solution, it hardened in five minutes. Mixed with one drachm of an 0·5 per cent sodium chloride solution, it hardened in five minutes. Mixed with one drachm of a five per cent calcium chloride solution, it hardened in six minutes and a half. Mixed with one drachm of tap water, it hardened in nine minutes. Mixed with one drachm of distilled water, it hardened in nine minutes. Mixed with one drachm of saturated solution of sodium chloride, it hardened in eighteen minutes. Mixed with one drachm of a five per cent solution of glycerin in distilled water, it hardened in nineteen minutes. Mixed with one drachm of a five per cent solution of white of egg in distilled water, it hardened in twenty minutes. Mixed with one drachm of a ten per cent solution of white of egg in distilled water, it hardened in twenty-five minutes. Mixed with one drachm of a ten per cent solution of glycerin in distilled water, it hardened in thirty-five minutes. Mixed with one drachm of a twenty-five per cent solution of glycerin in distilled water, it hardened in sixty minutes.

These figures tell, says Mr. Belcher, their own tale, and show that where it is of importance to make plaster of Paris set rapidly it should be mixed with a five per cent solution of common salt, and this may be made roughly by adding a tablespoonful of salt to a pint of water.

An Ancient Hospital.

At Baden, near Zürich, Switzerland, in connection with recent excavations at Windisch, the Roman Vindonissa, an ancient military hospital has been discovered. It has fourteen rooms, which appear to have been well supplied with medical, surgical, and pharmaceutical apparatus, including probes, tubes, forceps, cauterizing implements, and even safety pins; medicine spoons of bone, silver measuring vessels, jars and pots for ointments, etc. Some coins were also found, those of silver being of the reign of Vespasian and Hadrian, those of copper bearing the effigy of Claudius, Nero, Domitian.

At Vindonissa, two great Roman military roads meet—one leading from the great St. Bernard along Lake Leman and then by Aventicum and Vindonissa to the Roman stations on the Rhine; the other from Italy to Lake Constance by the Rhætian Alps, the present canton of Winterthur, Baden, and Windisch. This last point was the station of the seventh and eighth legions.

Artificial Albumen.

A cable dispatch to The New York Sun says that Dr. Leo Lillienfeld, of Vienna, has demonstrated to the Chemical Congress in session in that city the discovery of the method of producing artificial albumen which is absolutely identical to natural albumen, which hitherto has been believed could be produced only by chemical means. Dr. Lillienfeld calls the product "pepton." At present no further details are obtainable, so it is impossible to say whether or not the process is a practical one from a commercial point of view.

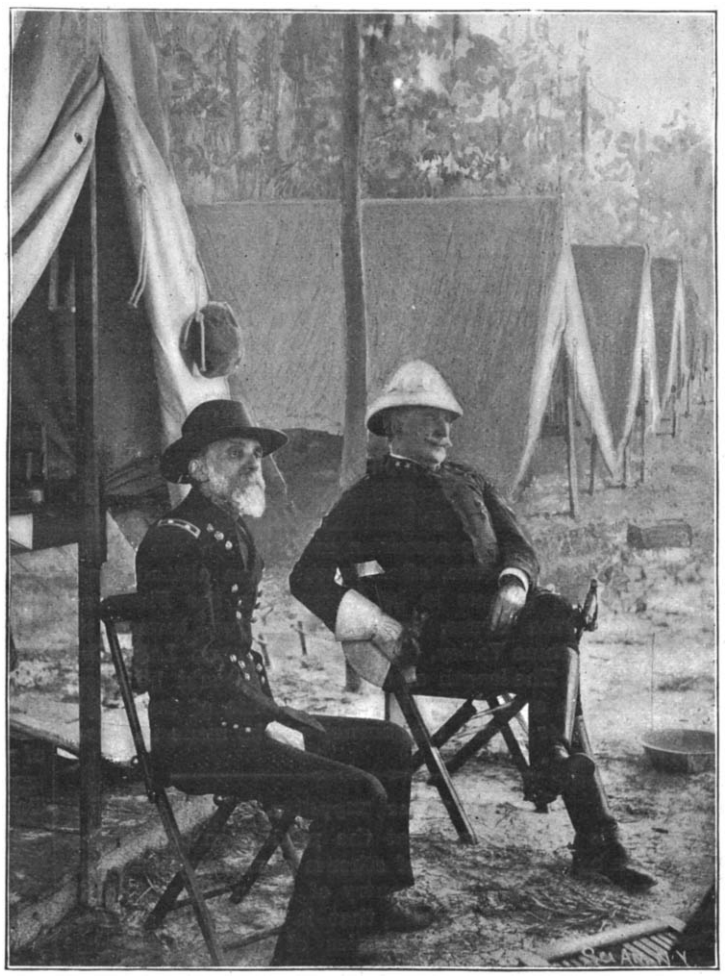
MAJOR-GENERALS MILES AND WHEELER.

The accompanying photograph represents Major-General Miles and Major-General Wheeler in conference before the tent of the latter.

Major-General Nelson A. Miles, who commands the army, was born in Massachusetts in 1839, and is not a graduate of the Military Academy at West Point. He was made captain of the 22d Massachusetts Infantry in 1861 and was honorably mustered out in 1862. In the same year he again enlisted, and was appointed Lieutenant-Colonel of the 61st New York Infantry. He became a Colonel in September, 1862, and was made a Brigadier-General in May, 1864. In October, 1865, he was made a Major-General, and was honorably mustered out on September 1, 1866. Up to this time he was in the volunteer army, but he was accepted as Colonel in the regular establishment of the 40th Infantry on July 28, 1866, and was made Brigadier-General in December, 1880, and Major-General April 5, 1890. General Miles has a long and honorable record. He fought at Fair Oaks and Malvern Hill and commanded a brigade in the Wilderness, Spottsylvania, and Fredericksburg. Since he entered the permanent establishment he has been very successful in waging war against the Indians on the Western plains. Personally, he is much liked, and is considered the true type of the gentleman-officer. He was chosen to take part in the Queen's Jubilee in 1897. He was also with the Turkish army in the Græco-Turkish war in order to observe the war maneuvers.

General Joseph Wheeler is an ex-Confederate officer and was appointed Major-General of Volunteers, by President McKinley. General Wheeler was born in 1836 and entered the Confederate army at the age of twenty-five. He was successively promoted to the command of a regiment, brigade, division, and army corps, and as early as 1862, when he was only twenty-six years old, he was made Major-General and had been assigned to the command of the Confederate cavalry corps of the Tennessee army. He commanded Gen. Bragg's cavalry at Green River and at Perryville; he led the cavalry at Murfreesboro and at Chickamauga. In a raid in Tennessee, in 1863, he destroyed national stores to the value of $3,000,000. He engaged at Knoxville, Missionary Ridge, and Lookout Mountain. He harassed General Sherman in his march to the sea and fought at Atlanta and Aiken. He was elected to Congress from Alabama as a Democrat, and has served continuously since 1885.

One of the interesting features of the war is the drawing together in the bonds of unity those who, only a quarter of a century ago, were facing each other in hostile array. Such political sections as the North and South no longer exist, and the public has a like interest in our military leaders irrespective of the part of the country from which they come.



CONFERENCE BETWEEN MAJOR-GENERALS MILES AND WHEELER.

CARD CRICKET.

BY W. B. CAULK.

One of the most effective and pretty tricks performed by the celebrated English magician Mr. Devant is known as "Card Cricket." In this trick the performer shows his hands empty, and takes a pack of cards and requests three ladies to take one card each, and to remember what the cards are. The cards are then replaced in the pack, which is well shuffled and cut by one of the audience. The performer then passes for inspection an ordinary cricket bat, which on its return he places on a table in full sight of all. He then asks if any one in the audience can bowl, and requests the gentleman who can to come and have a game at cricket.

The performer now asks the gentleman to take the pack of cards and bowl at him, and he will be the player or one at the wicket. The performer picks up the bat and says "Play." The cards are bowled at him, and he hits the pack with the bat as the cards are in the air, and, to the astonishment of the audience, the chosen cards are seen sticking to the bat. This very pretty card trick is quite simple to work.

In selecting the cards the ladies were under the impression that they exercised their own free will, but such was not the case. The pack of cards was what is known to magicians as a forcing pack, that is, consisting of only three cards, which for convenience sake we will say are the ace of clubs, five of hearts, and nine of spades, one-third of the pack being composed of only one of these cards. The pack being thus made up, it is very easy for a skillful performer to present to the first lady the portion of the pack containing only ace of clubs, to the second lady the part consisting solely of five of hearts, and to the third lady the part that contains only nine of spades. By using such a forcing pack the performer is sure to have the proper cards selected.

While the ladies are examining their cards the performer steps to his table on some pretense and slyly changes the forcing pack for an ordinary one consisting of the usual cards, with the exception of the five of hearts, ace of clubs, and nine of spades. This pack he hands to some member of the audience and requests them to have replaced the selected cards and shuffled.

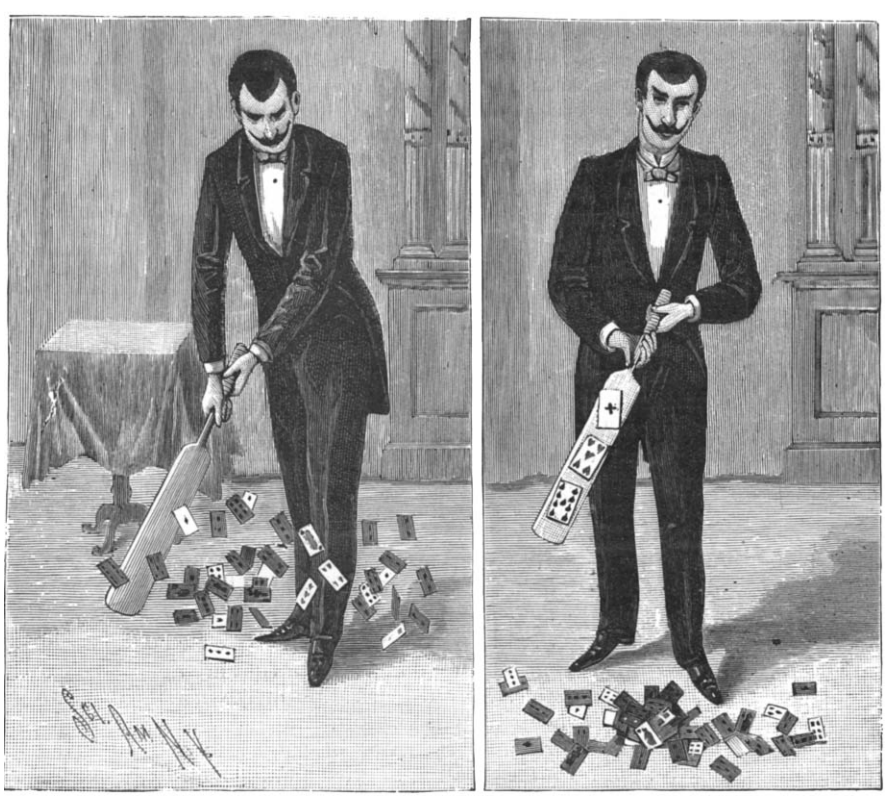
The cricket bat is an ordinary one, which, after being examined by the audience, is laid on a table until the performer finds a gentleman who will bowl the pack at him.

In this simple act of laying the bat on the table we find the principal secret of the trick.

Previous to beginning the performance the magician has placed face down on the table, in a line with each other, an ace of clubs, five of hearts, and nine of spades. The back of each of these cards is lined with cloth similar to the covering of the table, thus preventing anyone noticing the cards when placed face down on the table. On the cloth covering of each of the cards is smeared a dab of soft adhesive wax. In placing the bat on the table, care is taken to lay it directly over the three cards, the wax on the backs adhering tightly to the bat.

After the gentleman who has consented to bowl the pack of cards at the performer is in place, the performer picks up the bat, steps back a few feet, and says "Play." The instant the flying cards touch the bat the performer turns it over, bringing into view the side of the bat to which the three cards are sticking, which appear to have been caught on the bat from the flying cards.

Until the pack of cards are thrown against the bat, the magician exercises the greatest care not to turn the side of the bat to which the cards are sticking toward the spectators. Properly presented, this trick has proved most illusive.



CARD CRICKET.

The Umbrella Industry.

More than one-half of the umbrellas used in this country are produced in Philadelphia, and the distinction of the Quaker City in this respect is no new thing, for it has passed almost into a proverb throughout the United States that "when the Quakers come to town, it is going to rain." Very few persons have any correct idea of the extent of the umbrella business in the United States, says The New York Sun. It amounts in a year, taking the retail figures, to $25,000,000. There are in this country five hundred umbrella factories, having an invested capital of $6,000,000, of which more than $3,000,000 is in the city of Philadelphia alone. New York, Massachusetts, Maryland, and Ohio are the other States which are largely represented in the manufacture of umbrellas, while all the States are represented, though unevenly, in their sale.

For many years some of the best umbrellas were imported from abroad, especially from England, and the rate of duty upon them prior to 1890 was 50 per cent ad valorem if covered with silk or alpaca and 40 per cent if covered with any other material, cotton or linen included. Under the tariff of 1890—the McKinley bill, so called—American umbrella manufacturers were favored by an increase in the duty of 5 per cent, the rate upon silk and alpaca covered umbrellas being 55 per cent and on those covered with other material 45 per cent. Since then the importations of English umbrellas have declined, though this change is not to be ascribed wholly to the workings of the tariff, but rather to the fact that American-made umbrellas are decidedly cheaper and quite as serviceable as those imported from other countries. Moreover, they have the additional advantage of being lighter and less cumbersome, and are not constructed to meet the requirements of hard and continuous usage, as is the general custom abroad; for the number of those who always carry umbrellas is materially larger on the other side than it is here. The American plan is to carry umbrellas only when it is raining or seems likely to rain, and it is a matter of common observation in American cities that there are more men who neglect, omit, or are unable to get umbrellas on rainy days than there are men who carry umbrellas when the weather is fair. This condition is exactly reversed in most European cities, where it is no uncommon thing to see many umbrellas carried on a bright, clear day. The average rainfall in inches is 25 in London, 23 in Paris, 24 in Berlin, 20 in Vienna, 17 in St. Petersburg, and 44 in Glasgow. The average in New York is about 40 inches, but the number of days in which there is some rain is larger abroad than it is here.

There are in the United States more than eight thousand persons (the larger number of them men) engaged in umbrella manufacture, and the total wages paid in a year in this branch of American industry exceeds $4,000,000. What peculiar merit the city of Philadelphia offers to umbrella makers is not easily stated. The materials which enter into umbrella manufacture are not procurable with any unusual advantage in Philadelphia, and the chief market of sale is New York.

IN a work on the algal flora of the Hamburg waterworks, Herr O. Strohmeyer states that the green algæ—Cladophora, Spirogyra, Enteromorpha, Stichococcus, etc.—have a very powerful effect in purifying water by the destruction of bacteria through the agency of the oxygen which they exhale. Those algæ, on the other hand, which are inclosed in a mucilaginous sheath, especially diatoms, have a very prejudicial effect on drinking water, by stopping the filters through which it passes.

Terrestrial Coronium.

As we briefly noted in our issue of July 30, Prof. Nasini, of Padua, who has been working in conjunction with Signori Anderlini and Salvadori, communicates the following note to the French Academy:

"We have for a considerable time been occupied with an extensive study of the gases emanating from the earth in various parts of Italy, with the object of detecting the presence of argon and helium, and possibly of other elements they may contain.

The first part of this work has already been published ("Gas delle terme di Abano," Gazzetta Chemica Italiana). We are now completing the study of the gases of the Solfatara di Pozzuoli, Grotta del Cane, Grotta ammoniacale, and of Vesuvius. In the spectrum of those of Solfatara di Pozzuoli, which contain argon, we have found a sufficiently bright line with the wave length 531·5, corresponding to that of corona, 1474 K, attributed to coronium, an element not yet discovered, and which should be lighter than hydrogen. This line has never before been observed in earthly products. Besides, we have noted the following lines: 653·5, 595·5, 536·2.

In the spectrum of the gases gathered from the fumarole of Vesuvius, we have observed the lines 769·5, 631·8, 572·5, 536·5, 441·5, and again 595·5. These lines do not all belong to the spectrum of argon or helium; they show a coincidence or proximity only with some unimportant lines of various elements, such as iron, potassium, and titanium. Considering the conditions of our experiments, the presence of these elements in the gases we have studied is not probable. The line 572·5 is near to one of nitrogen, but, being the only visible line of the spectrum of this gas, it cannot be attributed to it. Besides coronium we have thus probably other new elements in these gases.

We are diligently pursuing their investigation."

This is an announcement of the highest interest from a scientific point of view, as at once confirming the results of spectroscopic examination of the sun and adding another proof of the substantial identity of materials in the sun and the earth. Hitherto nothing has been known of the substance which produces the coronal line 1474 K. It has not been observed anywhere in nature except in the corona, its supposed identity with the auroral line having long ago been disproved, although it may possibly be asserted here and there in a text-book not written up to date. Coronium would seem, however, to be a substance with a vapor density far smaller than that of hydrogen, which is by far the lightest body with which we are familiar. Some have suggested that it is only one of the elements known to us, modified in some unknown way by conditions differing enormously from those that obtain on this planet. But against this hypothesis has to be set not only its occurrence at a distance from the sun's body estimated at 300,000 miles, where it is difficult to believe that the vapors of the suggested elements can predominate, but also the fact that in the midst of solar disturbances, in prominences or near sun spots, when the lines of hydrogen and other known elements are contorted, this coronal line remains sharp, fine, and straight. From these and other considerations it has been held that the green coronal line is due to a permanent component of the solar atmosphere totally distinct from any element known to terrestrial chemistry. That unknown substance appears now to have been found just where, if anywhere on earth, it might be expected—i. e., in the gases from volcanoes or the springs and minerals subject to volcanic action. It will be observed that even with this addition to the list of known elements the lines in the spectra of the volcanic gases cannot be completely accounted for. It is therefore probable that coronium will be found to be associated with other gases as yet unnoticed.—The London Times, July 20, 1898.

Ballooning in the High Alps.

An interesting attempt in behalf of science will be made this summer by Capt. C. Spelterini to cross the high Alps of Switzerland in a balloon, for the purpose of making meteorological and topographical observations, says J. T. Du Bois, United States Consul-General at St. Gall. The Swiss weather bureau and many Swiss scientists are interested in the venture. If successful, it will be the first air ship that has ever crossed the high Alps.

The principal parts of the balloon have already been constructed in the factory of George Basacon, at Paris, and the basket, network, and other features are being perfected as rapidly as possible. The dimensions of the balloon are as follows: Diameter, 60·39 feet; contents, 115,414 cubic feet; weight of balloon basket and network, about 2,020 pounds; carrying power, 7,400 pounds.

The movement of the balloon is to be ascertained by topographical and barometrical observations; one registering aneroid barometer and one controlling quicksilver barometer will be used for this purpose. At the time of the journey frequent observations are to be made at the Swiss meteorological stations, and by this plan the coexisting differences of the direction and rapidity of the wind in the various high strata of air are hoped to be obtained. Careful observations are to be made from the air ship as to the humidity and temperature, as well as to the color phenomena of the atmosphere, strata of vapor, formation of clouds, etc. One of the most important and interesting results expected is the photographing of mountains from the balloon. The point of view from which these photographs must be taken in order to be of the greatest use for cartography, geography, geology, as well as for best execution, has been carefully planned; and important results are confidently expected. The science of photography is also to be used in the study of the formation of vapor and clouds in high Alpine altitudes.

The question of from what point and in which direction the aerial journey shall be made has been thoroughly studied by some of the best known Swiss scientists. Government meteorologists stationed at the highest possible altitudes in Switzerland claim that it is impossible for a balloon to sail over the high Alps from north to south or from south to north, because the south winds are not strong enough to reach the higher air currents, and the strong north winds are so rare that no dependence can be placed upon them. The prevailing wind in the high Alps is from the southwest, and Capt. Spelterini claims that, in nearly all of his aerial expeditions in Switzerland, he has been driven northeast whenever he passed an altitude of 10,000 feet. By this experience, he is satisfied that by ascending in Lugano he would, as soon as he had reached the altitude of 10,000 feet, be driven into the Tyrol Mountains. It has therefore been decided that he shall make the ascension at Sitten, in the Canton of Wallis, whence, after reaching an altitude sufficient, he expects to be driven over the Finsteraar group, the Urner, and Glarner Alps, toward the Upper Rhine Valley, between Sargans and Lake Constance. The length of this journey would be about 130 miles, and, if the wind is at the rate of from 19 to 32 feet per second, the journey will be made in about 8 hours.

Ether Tippling.

It is well known that the production of intoxication by the drinking of ether is a vice especially prevalent among the peasantry of the north and northwest portions of Ireland, that it obtains in some degree in the western counties of England, and also that it sometimes finds its way into the boudoirs of titled and aristocratic dames; but until recently it was held to be strictly confined to the United Kingdom, except, perhaps, in rare and isolated instances. In Viertehjahrsschrift für Gerichtliche Medicin, the medical officer of health for the district of Heydekrug in Lithuanian Prussia draws attention to the fact that ether tippling is there excessively prevalent and constantly increasing—a condition he ascribes to recently increased excise duties advancing the price of spirits and practically inhibiting their use by the lower classes, who are chiefly of the Slav race. It is added the vice is an importation from Russia, it being in some districts of the Muscovite empire "perniciously prevalent." "Mere children," it is declared, "often come to school exhibiting signs of having imbibed ether before leaving home; mothers give to their offspring to relieve abdominal pain; and on market days the odor of the drug is perceptible everywhere in the respiratory exhalations of the peasantry, of both sexes, and when a vehicle occupied by them is encountered on the highway, a cloud of ether seems to float along."

It is not, however, the commercial drug, or that prepared for purposes of anæsthesia, that is employed, but the compound spirit, known as "Hoffman's Anodyne" or "anodyne drops," which is merely commercial sulphuric ether diluted with three parts of alcohol. The exhilaration produced is declared to be much more pleasurable than that accruing to alcohol; the drug is not only less expensive, but requires a less amount to produce intoxication; and that the subsequent depression and discomfort ("katzenjammer") are less marked. It might be added, also, that the stage of exhilaration is much more transient and leads to more frequent imbibition.

One thing is notable, viz., that outside of surreptitious employment, the use of ether as a beverage and intoxicant is confined to peoples whose social and hygienic conditions leave much to be desired, people with whom complete intoxication rather than mere stimulation is the desideratum.

That ether as a beverage and intoxicant is much more pernicious than alcohol, may be imagined; it is also much more seductive in its influences, once the individual is habituated thereto. The injuries accruing to the habit are more rapidly induced, and generally farther reaching than those derived from beverages of purely spirituous nature; chronic catarrhs that are absolutely irremediable, fatty degeneration of the heart, calcification of the great blood vessels, "hobnail" liver—a cancerous condition—softening of the brain and other cerebral troubles leading to great mental debility and even to complete idiocy, are the common sequels claimed to obtain to this vice. In any event, the injurious effects are such as to warrant the restriction of the sale of ether, whether the commercial article or in the form of "Hoffman's drops," and also to requiring these drugs to be classified with opium, arsenic, chloral, chlorodyne, cocaine, Indian hemp, and other concomitants of the chemist's shop that are not permitted to be dispensed save on the prescription of a qualified medical practitioner. Practically the same should also accrue to chloroform, the seductive odor of which has led in many instances to its inhalation by drug clerks to secure an intoxicating effect.

The startling, increased, and general consumption of substitutes for alcoholic beverages, and the vast market found for cheap and drugged spirits, raises again the pertinent question whether the restriction placed upon the sale of absolutely pure products does not work harm rather than good; whether the enforcement of laws insuring purity will not better serve the cause of temperance. Possibly acts that will combine the two measures will produce the best results. It is known that, since the embargo on home-brewed ales has been in force, the consumption of spirits has greatly increased in Great Britain, and far beyond any ratio of increase in population; that more public houses are in existence; cologne drinking, chloral and cocaine taking, ether tippling, and the consumption of narcotic drugs generally, are in common vogue and daily, almost hourly, assuming enlarged proportions. Here is one of the greatest problems of our sociology, one that is, apparently, as far from solution as it was a century ago. The outward appearance as regards consumption is more seemly, but the surreptitious consumption of narcotics is in no way mitigated, but rather the contrary. The thanks and honors of the world await the individual who can formulate a scheme of reform that will be alike practicable and effective.

The Current Supplement.

The current SUPPLEMENT, No. 1180, is of rather more than usual importance, as it contains a number of papers on a variety of subjects of very present interest. "A General Description of the Whitehead Torpedo" is an article which is illustrated with elaborate and detailed drawings, showing the intricate and ingenious mechanism by which the torpedo is driven and guided. It is accompanied by fifteen engravings. "The English Dumdum Bullets" describes the bullet which is used by England against savage nations. The bullet becomes distorted on striking a soft body and produces wounds which are very serious. "A New Bulkhead Door" describes the Kirkaldy bulkhead door which seems to afford entire immunity from accidents. "Engines and Boilers of H. M. S. 'Europa'" illustrates the engines of the new first-class protected cruiser of 11,000 tons. "The Present Status of the United States Navy" is accompanied by tables giving a full list of cruisers and yachts, steamers, colliers, revenue cutters, and also the vessels under construction, together with the names of all of the new vessels. "The Development of the Calcium Carbide Industry" is a full paper giving the entire history of the industry. The "Analysis of a Horse's Motions by Chronophotography" is an article from the pen of Prof. E. Marey, who is a great authority on the photography of moving objects. The different gaits of a horse are studied in detail. "How to Select a Telephone" is a practical article by Mr. H. P. Clausen.

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RECENTLY PATENTED INVENTIONS.

Mechanical Devices.

DRILL-CHUCK.—WILLARD H. MERREL, Oneida, N. Y. To provide means whereby a drill or like tool may be firmly held in place to prevent it from turning in the jaws, this inventor provides a chuck whose body-portion has a transverse seat. Two jaws slide toward and from each other in this seat and meet at the center of the chuck. Interlocking fingers on the jaws hold the drill. The jaws have respectively right and left hand threads at one side, and at opposite sides are provided with shoulders. The enlarged end portions of a screw-rod bear against shoulders on the body, are oppositely threaded and are engaged respectively with the threads on the jaws. By this means the jaws are advanced and retracted. Two screws working in opposite sides of the body and having heads engaged with the shoulders on the jaws, lock the jaws in place.

MAGAZINE BOLT-GUN.—JOHN H. BLAKE, New York city. The fire-arm patented by this inventor is capable of being used either for single or for magazine firing, a simple and easily operated cut-off being provided, by means of which the magazine may be brought into or thrown out of action as desired, the magazine when not in action remaining in the gun. A cartridge-packet is also provided in which a number of cartridges may be quickly placed. Only a single packet is placed in the magazine-chamber. This magazine-chamber is so constructed that the packet, while normally concealed, may be rendered visible at any moment. The packets are made so as to be carried loaded in a belt as is customary in carrying single cartridges, thus enabling a marksman to substitute quickly, a loaded for an empty packet in the magazine, a cartridge being at the time within the barrel ready to be fired. The bolt is so made that its parts may be easily separated and assembled again. In addition to its usual function, the sear in this gun is employed to prevent a rocking movement of the bolt when the latter is in firing position.

WEIGHING AND FILLING APPARATUS.—JOSEPH E. J. GOODLETT, Memphis, Tenn. In this invention we find means for filling receptacles with liquids, for delivering a predetermined quantity of the fluid, and for cutting off the delivery automatically. The apparatus includes, as its chief features, a weighing scale upon which the liquid receptacles are placed to be filled, a filler proper, which is provided with automatic valve and trip mechanism for controlling the flow and delivery of liquid, and an electrical switch and circuit and co-operating devices for actuating the trip mechanism when the weight of the liquid delivered into a receptacle reaches the predetermined limit.

Railroad Appliances.

COMBINED DUST-GUARD, CAR-AXLE LUBRICATOR, AND HOT-BOX INDICATOR.—JAMES S. PATTEN, Baltimore, Md. The dust-guard provided for in this invention has, connected with the axle-box, a curved supporting spring whose convex portion bears upon the bottom and outer end of the axle-box and whose extended outer end rests upon the bearing of the journal, whereby the dust-guard is elastically held in place. The lubricator consists of a roller running in a stratum of oil and so pivoted to the upward and recurved rear ends of the spring that it will take up and transfer oil to the journal. The "hot-box" indicator operates in a box or holder having open perforations and means for supporting the latter in the axle-box above the oil-space, and holding it in contact with the bearing. In the box a substance is placed capable of emitting a strong, easily-perceiv d odor when the oil runs out and the friction heats the substance, thus indicating the presence of a "hot box."

CAR-COUPLING.—HERMÉNÉGILDE and AIMÉ LOISELLE, Winnipeg, Canada. The purpose of this invention is the provision of a simple and effective car-coupling, which shall couple cars automatically when they come together, which shall not come apart accidentally nor cramp and bind in turning curves and which shall be adapted to couple cars having the ordinary construction of draw-bar and the ordinary link and pin coupling. The coupling has a pair of jaws pivoted on horizontal axes and having tapered noses and grappling surfaces, each face having a central recess with a lip at top and bottom. A lug partly closes one end of the recess and has a notch at the top and bottom of the lug for the purpose of locking the jaws against vertical as well as horizontal motion.

CAR COUPLING.—VALENTINE ERBACH, Scranton, Pa. This coupler is of the knuckle-type and is so constructed that it will be of less dimensions than ordinary knuckle-couplers, will not present any unnecessary side projections and will be simple and durable. In this coupling a draw-head is provided having a long and a short horn at opposite sides, the long horn being chambered and having a shoulder formed between its ends. A knuckle mounted to swing in the chamber of the long horn has a vertical shoulder in line with the shoulder in the long horn, and at its pivot point has its lower surface inclined and engaging a correspondingly-inclined surface on the draw-head. A release-lever is pivoted to the knuckle and is adapted to engage with its head an opposing knuckle when two draw-heads are brought together and are in coupling position.

BICYCLE SADDLE.—LOUIS P. WELLMANN, Union, Hudson County, N. J. This saddle is made to form a flexible seat which may yield with the motions of the rider and which may be adjusted in width. The saddle has two independent seat-portions each with a depression of irregular shape in its upper face, which depression is adapted to fit the body. A stem is formed integral with each seat-portion, the stem and seat-portion being composed entirely of rubber, whereby the seat-portion will yield to the weight of the rider and bend as a whole with respect to the stem so as to conform with the position of the thigh.

SASH-FASTENER.—LEWIS H. BOWMAN, Walla Walla, Wash. The purpose of this invention is the provision of a fastener which shall lock a sash in any desired position without rattling and which shall make a tight joint between the sash and casing. The sash-holding device comprises a vertically moving sash-locking member, a horizontal lever pivoted beneath the window-sill, connections from one end of the lever to the sash-locking member, a bent hand-lever pivoted by one end beneath the sill and having an arm lying flush with the sill when the window is locked, and a link connecting the lever near its bend with the other end of the first-named lever. The pivots on the hand-lever and its connected link are nearly in line when in locked position, the center pivot being sufficiently at one side of the center line to hold the parts locked.

SNAP-HOOK.—CHARLES F. FRANCISCO, Lakeside, Cal., and EUGENE E. SHAFFER, San Diego, Cal. This invention has for its purpose the provision of a simple, cheap, and efficient snap-hook which remains firmly in locked engagement with the ring or buckle to which it is coupled. The snap-hook comprises a frame portion having a hooked portion and three cross-pieces, of which which the first two are at the lower side, with an open space between them, the third cross piece being arranged at the upper side and between the first two cross-pieces. A U-shaped spring has its lower bent end hooked over the second cross-piece, its middle bend surrounding the first cross-piece and its free end pressing upwardly. A latch is arranged within the frame above the free end of the spring.

HARNESS ATTACHMENT.—WILLIAM R. PHILLIPS, Pomona, Cal. The attachment provided for by this inventor may be applied to any harness, and is arranged to hold the lines in proper position so as to prevent entanglement with other parts or with the horse's tail. The attachment comprises a loop having at one end means for securing it to a strap and having its rear member split or separated to form an opening for the entrance and removal of a line and provided with lugs for engaging apertures in the strap to which the loop is attached.

PIPE-COLLAR.—EDWARD J. MALLEN, New York city. This pipe-collar is made with a body plate constructed in removable sections. Clamping plates are adjustably and removably held in the body plate and are made of spring-material. End clamping plates are mounted to slide in engagement with a central clamping-plate, each clamping-plate having a pipe-receiving opening and divided at a portion in its surface. This division extends from the pipe-receiving openings to the outer edges of the plates. The device is applicable to all kinds of pipes and will not mar the appearance of a ceiling or wall. Fire-proof material may be filled in around the pipes, thus deadening all noise and preventing dirt from dropping down.

Designs.

HOSE REEL SPOOL.—HARRY E. DONNELL, New York city. This design consists of a hub from each end of which extend spokes arranged in pairs, the inner end of the spokes of a pair being separated and the outer ends being joined and terminating in a circular rim. The inner end of one spoke in a pair, joins the inner end of the adjacent spoke of the next pair.

GAME-BOARD.—WILLIAM B. GILES, New York city. In this design, the surface of a game-board is divided into two parts or fields, with a groundwork of contrasting colors and with a series of disk-like figures, the color of one series of figures differing from that of another.

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LOGIC, DEDUCTIVE AND INDUCTIVE. By Carveth Read, M.A. London: Grant Richards. 1898. Cloth, 12mo. Pp. 323. Price £0.6.

This work more definitely separates logic, pure and simple, from all other studies, and especially from psychology and metaphysics. It is, in fact, a concise and comprehensive textbook of logic, the mastering of which is made more easy by the aid of questions that are introduced as an appendix.

ELECTRO-DYNAMICS—THE DIRECT CURRENT MOTOR. By Charles Ashley Carus-Wilson, M.A. London and New York: Longmans, Green & Company. 1898. Cloth, 16mo. Pp. 298. Price $1.75.

The aim of this volume is to apply the principles of electro-dynamics to the direct current motor. As it is a work intended for the enlightenment of electrical engineers, the author takes it for granted the reader is familiar with the use and design of motors; but he in the main avoids all technicalities, hoping thereby to render the volume useful to engineers generally.

THE CURE OF WRITER'S CRAMP AND THE ARM TROUBLES OF TELEGRAPHERS AND BALL PLAYERS. By S. H. Monell, M.D. New York: J. B. Taltarall. 1898. Pp. 49. Paper 8vo. Price 50 cents.

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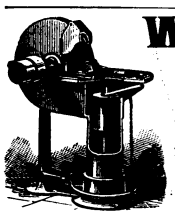

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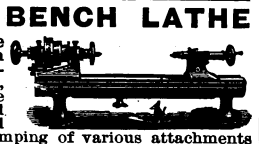

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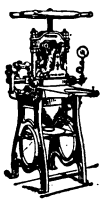

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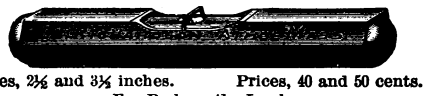

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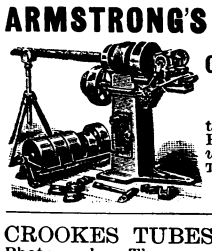

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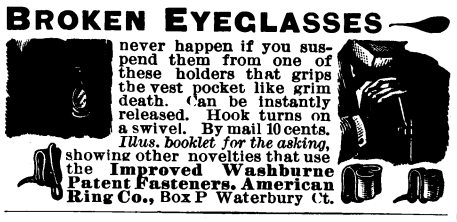

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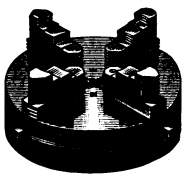

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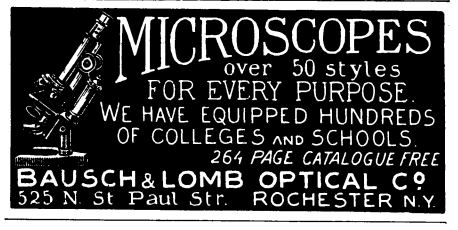

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